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A new species of *Melaleuca* (Myrtaceae) from northern Queensland, Australia

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Abstract

Melaleuca sylvana Craven & A.J. Ford is described from the Herberton-Ravenshoe area in northern Queensland. A key to the microphyllous species of *Melaleuca* in northern Queensland is provided.

Introduction

During field studies in northern Queensland by the first author in 2001, the second author drew attention to an unusual microphyllous *Melaleuca* that occurred in the Herberton region on the western edge of the Atherton Tableland. The population was visited and specimens collected for later study in the herbarium. In the field it was observed that the plants were superficially similar to *M. monantha* (Barlow) Craven but differed from that species in having, inter alia, a more typical tree-like habit and larger fruit. *Melaleuca monantha* typically occurs as densely crowned, multistemmed plants although some collectors have noted on specimen labels that the plants were trees (but without indicating whether they were multibranched or not). The Herberton plants we observed were sparsely crowned and single-stemmed.

Subsequent comparison of the Herberton material with herbarium specimens of *M. monantha* established that they differed in a number of characters. The more distinctive of these are listed in Table 1. In view of these differences, which are consistent with, if not exceeding, differences accepted for species segregation in other *Melaleuca* complexes in the *Flora of Australia* account of the genus (Craven *et al.* in press), it is concluded that the Herberton specimens represent a previously unknown species of *Melaleuca*, described below as *M. sylvana*.

Taxonomy

Melaleuca sylvana Craven & A.J. Ford, *sp. nov.*

A *M. monantha* (Barlow) Craven hypanthio longiore (2-2.2 mm longo), filamentis staminalibus longioribus (7-8.5 mm longis), stylo longiore (8-10 mm longo), et hypanthio in fructu longiore (4-4.25 mm longo) differt.

Type: Australia: Queensland: Cook District: Powerline access road, W of Herberton, c. 1.85 km along road from the Herberton-Watsonville road, 6 December 2001, *Craven & Ford 10430* (holotype BRI; isotypes A, ASU, B, BISH, CANB, E, G, L, MEL, NSW, P, US).

Tree or shrub to 5 m tall, open-crowned. *Bud scales* absent. *Branchlets* glabrous, terete, excavated (i.e. impressed) adjacent to the leaf blade. *Leaves* decussate, imbricate, amplexicaul, peltate, ascending (blade is appressed proximally at the point of attachment to the branchlet but is ascending distally), distinctly dorsiventral, 1.5-3.7 mm long, 0.9-1.7 mm wide, 1.4-2.3 times as long as wide, sessile; *leaf blade* glabrescent, the indumentum

Table 1. Differenees between two species of *Melaleuca*

Character	*M. monantha*	*M. sylvana*
Habit	Densely foliaged shrub or tree to 7 m tall	Open shrub or tree to 5 m tall
Leaf hairs	Spreading	Ascending
Leaf blade	Angular-obovate	Rounded-obovate (never angular)
Leaf blade vein number	5-7	7-11
Hypanthium	1.3-1.8 by 1.1-1.3 mm	2-2.2 by 1.9-2 mm
Calyx lobes	0.5-0.7 mm long	0.8-1 mm long
Petals	Obscurely clawed	Distinctly clawed
Petals	1.2-1.6 mm long	2 mm long
Petals	Oil glands absent	Oil glands present
Staminal filaments	4.5-6.8 mm long	7-8.5 mm long
Staminal bundle claw	2-3.5 mm long	4.25-4.5 mm long
Staminal filaments	Free portion inserted in the distal half to three-quarters of the bundle claw	Free portion inserted in the distal quarter of the bundle claw
Anthers	0.2-0.3 mm long	0.4-0.6 mm long
Style	5-6 mm long	8-10 mm long
Ovules	20 per locule	27-30 per locule
Infructescence	6 mm in diameter	9 mm in diameter
Fruiting hypanthium	2-3.2 by 2.5-4 mm	4-4.25 by 4.25-5 mm
Seed	0.8-0.9 mm long	1.1-1.3 mm long
Cotyledons	c. 1/2 the length of the embryo c.	1/3 the length of the embryo

with minute very ephemeral puberulous hairs on the distal abaxial surface and deciduous cilia on the margin, dull-glossy to dull, greenish or brownish, obovate or broadly obovate (to obovate-elliptic), in transverse section lunate (i.e. concavoconvex), sublunate or strongly so, in lateral view straight to recurved (the apex slightly incurved), the base truncate, the apex truncately acuminate to obtusely and shortly acuminate or acuminate, the 7-11 veins parallel; oil glands moderately dense to sparse, distinct or obscure, circular. *Inflorescence* a head or short spike of (1-)2-10 monads inserted interstitially in the median to distal axils of the reproductive seasonal growth flush, 8-18 mm wide, the rachis puberulous, each monad subtended by a foliage leaf and the flower by a pair of bracteoles. *Hypanthium* glabrous, pale orange, costate-cylindrical to cup-shaped, proximally not compressed, 2-2.2 mm long, 1.9-2 mm wide. *Calyx lobes* 5, abaxially glabrous, costate, herbaceous in the proximal-central zone and scarious in a narrow marginal band 0.1-0.2 mm wide, the margin ciliate, very broadly ovate to very broadly triangular, 0.8-1 mm long, persistent at least until the immature fruit stage. *Petals* deciduous, glabrous, pure white, sometimes flushed cream, distinctly but very shortly clawed, subcircular, 2 mm long, margin ciliate; oil glands circular. *Stamens* in 5 bundles, imperfectly 2-seriate, 9-12 per bundle, staminal ring absent; *filaments* glabrous, pure white, 7-8.5 mm long, the bundle

claw 4.25-4.5 mm long and 0.5-0.6 times as long as the filaments, the free part of the filaments inserted on the claw margin only and in the distal quarter of the claw; *anthers* generally uniform in size, oblong, 0.4-0.6 mm long, the connective not prominently glandular. *Ovary wall* adnate to the hypanthium for the proximal one-quarter only; placentation axile-median (although very near the base of the locule); *ovules* 27-30 per locule. *Style* glabrous, straight or more or less so, 8-10 mm long, the stigma punctiform. *Infructescence* longer than wide to shorter than wide, 9 mm in diameter. *Fruiting hypanthium* subglobose, depressed subglobose or urceolate, 4-4.25 mm long, 4.25-5 mm wide, 0.8-0.9 times as long as wide, 2-2.5 mm wide at the orifice; calyx lobes replaced by sepaline teeth; staminophore not prominent, the inner distal wall of the staminophore with 5 reflexed free antesepalous triangular processes; valves inserted. Seed angular narrowly obovoid to narrowly obovoid, 1.1-1.3 mm long, the testa membranous; embryo with the cotyledons about one third its length, the cotyledons obvolute.

Etymology: The epithet is derived from the Latin *sylva*, wood, forest, woodland, in reference to the habitat in which this species is commonly found.

Phenology: Flowering period: December. Fruits apparently present in all months (collected in February, March, June and December).

Other specimens examined: **AUSTRALIA**: **QUEENSLAND**: COOK District: Baal Gammon, 29 March 1980, *Hyland 10370* (QRS): 3 June 1997, *Forster, Booth & Jensen 21214* (BRI). Toys Creek, W of Herberton, powerline access road, 4 February 1996, *Forster & Ryan 18443* (CANB); June 1996, *Ford 1739* (CANB, QRS): 25 May 1997, *Sankowsky & Sankowsky 1576* (BRI); 25 July 1998, *Bean 13732* (BRI). NORTH KENNEDY District: Mt Ronald, S of Ravenshoe, 23 December 1998, *McDonald s.n.* (AQ666176) (BRI). Mt. Ronald road, off Wooroora road, SW of Ravenshoe, 27 January 2004, *Ford & Hewett 4286* (BRI, CANB).

Distribution and ecology: *Melaleuca sylvana* has been recorded from two regions in the Herberton-Ravenshoe area on the western and southern side of the Atherton

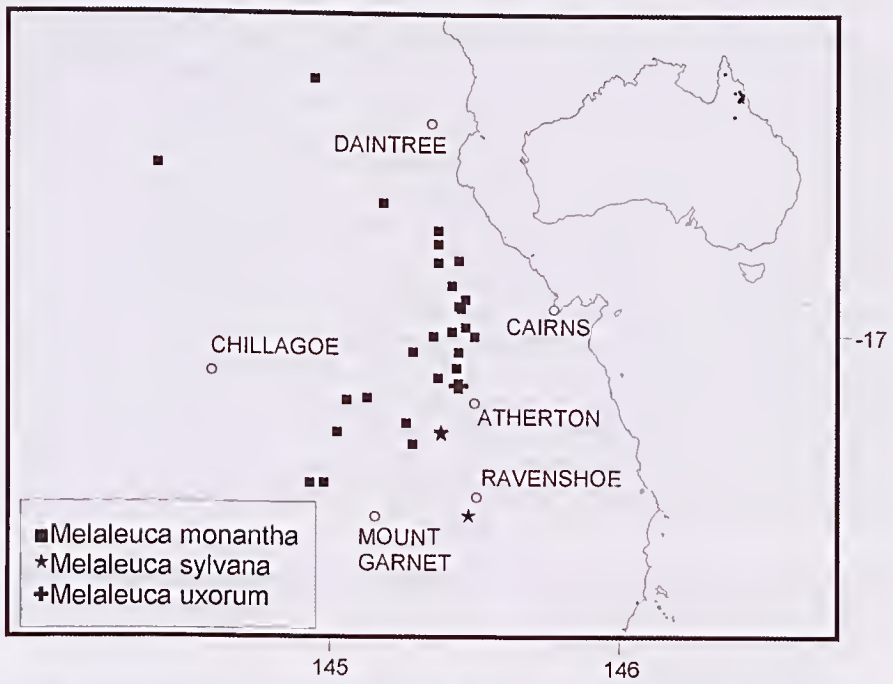

Figure. 1. Distributions of *Melaleuca* species. The inset map of Australia shows the entire distribution of *M. monantha*.

Tableland, on the Wet Tropics-Einasleigh Uplands bioregional boundary, at altitudes of (800-)1020-1050 m (Fig. 1). It has been recorded as occurring in open forest, in heath on rhyolite, in low open woodland of *Eucalyptus abergiana* and *E. shirleyi* with a closed heathland of *Melaleuca* and *Micromyrtus* on weathered rhyolite, in *Casuarina inophloia-Callitris*-eucalypt woodland on rhyolite, and in grassy woodland of *Eucalyptus citriodora*, *E. crebra* and *E. mediocris* on soil derived from rhyolite.

Conservation status: *Melaleuca sylvana* is currently not recorded in any protected area and lies outside the World Heritage Area of northeastern Queensland. We recommend that a detailed search be undertaken in adjacent habitats to fully assess the conservation status of this poorly known species.

Notes: The species is closely related to *M. monantha* from which it differs, inter alia, in the features given in Table 1. Also, *M. monantha* typically occurs in flat to slightly undulating areas at altitudes less than 700 m and on poorly drained soils with impeded drainage that suffer prolonged seasonal inundation. In contrast, *M. sylvana* typically occurs on steep rocky hillsides at altitudes above (800-)1000 m and the soils, although poorly drained, would rarely if ever experience inundation. *Melaleuca sylvana* has been observed to resprout after fire, with profuse epicormic and lignotuber shoots. In such instances the habit of the plant is more shrubby and less tree-like as a result of the periodic exposure to burning.

In the identification keys given in Craven & Lepschi (1999), *M. sylvana* keys out in Key 1 to *M. monantha* (Barlow) Craven. It may be inserted into Key 1 by replacing the second lead of couplet 6 with the following:

6. Hypanthium 1.3-1.8 mm long; staminal filaments 4.5-6.8 mm long; style 5-6 mm long; fruiting hypanthium 2-3.2 mm long.....*M. monantha* (Barlow) Craven
6a. Hypanthium 2-2.2 mm long; staminal filaments 7-8.5 mm long; style 8-10 mm long; fruiting hypanthium 4-4.25 mm long.....*M. sylvana* Craven & A.J. Ford

It is noteworthy that *M. sylvana* is the third species of the *M. minutifolia* F. Muell. species group to be recorded from the Atherton Tableland (Herberton Range) area. *Melaleuca monantha* was the first species to be recognised from this area (Craven & Lepschi 1999) and *M. uxorum* Craven, G. Holmes & Sankowsky the second (Craven *et al.* 2004). The distributions of the three species are shown in Fig. 1. This biological richness may be due in part to the environmental diversity experienced towards the western side of the Tableland; here altitude, climate and geology interact to produce considerably different localised vegetation types which in turn may foster evolutionary activity leading to speciation in lineages such as the present *Melaleuca* example. *Melaleuca sylvana* co-occurs with other significant and localised northern Queensland sclerophyllous endemic species such as *Micromyrtus delicata* and *Homoranthus porteri*. The Herberton Range is well known also for harbouring a distinctive warm-temperate floristic element in an otherwise tropical landscape. This is due to the elevation and the distance from maritime influences, which creates a more varied and extreme climate that is more similar to the Sydney Basin (for example) than the nearby tropical rainforested hillsides. The warm-temperate element includes such species as *Chorizema parvifolium*, *Melichrus urceolatus* and *Mirbelia speciosa*.

Key to the microphyllous species of *Melaleuca* in Queensland north of Lat. 20° S

1. Leaves more than 5 mm long ..... non-microphyllous *Melaleuca* spp.
1. Leaves less than 5 mm long
   2. Leaves decussate
      3. Flowers in triads .....*M. uxorum* Craven, G. Holmes & Sankowsky
      3. Flowers in monads

4. Branchlets hairy; style 1.5-2 mm long .....*M. foliolosa* A. Cunn. ex Benth.
4. Branchlets glabrous; style 5-10 mm long
   5. Hypanthium 1.3-1.8 mm long; staminal filaments 4.5-6.8 mm long; style 5-6 mm long; fruiting hypanthium 2-3.2 mm long ....*M. monantha* (Barlow) Craven
   5. Hypanthium 2-2.2 mm long; staminal filaments 7-8.5 mm long; style 8-10 mm long; fruiting hypanthium 4-4.25 mm long ....*M. sylvana* Craven & A.J. Ford

2. Leaves alternate
   6. Hypanthium glabrous; leaves sessile and peltate; trunk and major branch bark fibrous .....*M. tamariscina* Hook.f.
   6. Hypanthium usually hairy (rarely glabrescent); leaves sessile but not peltate; trunk and major branch bark papery .....*M. bracteata* F. Muell.

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New taxa in *Eucalyptus* (Myrtaceae) for Victoria and notes on Victorian populations of *Eucalyptus calycogona*

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Abstract

Seven new taxa of eucalypts endemic to Victoria are named and described and their distributions, ecologies, affinities and conservation status are discussed. These are *Eucalyptus litoralis* K. Rule, *Eucalyptus pyrenea* K. Rule, *Eucalyptus hawkeri* K. Rule, *Eucalyptus walshii* K. Rule, *Eucalyptus filiformis* K. Rule, *Eucalyptus tricarpa* L.A.S. Johnson & K.D. Hill subsp. *decora* K. Rule, and *Eucalyptus polyanthemos* Schauer subsp. *marginalis* K. Rule. As well, the discovery near Nurcoung in the Wimmera region of a small population of mallees with features consistent with *Eucalyptus calycogona* Turcz. subsp. *calycogona* is discussed.

Introduction

Recent surveys of several regions of Victoria have led to the discovery of many new *Eucalyptus* taxa, all of which are Victorian endemics and some of which are regarded as rare or threatened. *E. litoralis,* a mountain grey gum from the Anglesea area, *E. pyrenea,* a second mountain grey gum from the Pyrenees Range, *E. hawkeri,* a mallee-box from the Mt. Arapiles area, *E. walshii,* a second mallee-box from the Little Desert, *E. filiformis,* a third mallee-box from Mt. Jeffcott between Charlton and Donald, *E. tricarpa* subsp. *decora*, a copiously pruinose form of three-flowered ironbark from the St. Arnaud district, and *E. polyanthemos* subsp. *marginalis,* a depauperate red box from inland Victoria, which are treated below, represent the first installment of papers on these new taxa. Further, a small Victorian population of mallees with features consistent with *E. calycogona* subsp. *calycogona* is discussed.

Taxonomy

SECTION *MAIDENARIA*: SERIES *VIMINALES*: THE MOUNTAIN GREY GUM GROUP

It has been widely accepted that *E. goniocalyx* F. Muell. ex Miq., *E. cypellocarpa* L.A.S. Johnson, *E. nortonii* (Blakely) L.A.S. Johnson and *E. banksii* Maiden constitute a small complex of species within the series *Viminales* of the section *Maidenaria.* Features typifying this group include appreciably long adult leaves, buds with a waisted hypanthium and fruits with a descending disc and a more or less cupular shape. *E. cypellocarpa* can be distinguished morphologically from the other three species by its tall rather than stunted habit, its smooth bark, its square rather than terete seedling stems and its shortly pedicellate rather than sessile buds and fruits and ecologically by its preference for deep, fertile soils of wet, sub-coastal slopes and valleys rather than the drier, impoverished, mostly inland sites tolerated by the other species.

In recent years several new taxa regarded as having affinities with *E. cypellocarpa* have been erected. The first, *E. alaticaulis*, a smallish tree or mallee with variable box-like bark, broadly ovate juvenile leaves and winged seedling stems, was described by Watson and Ladiges (1987) to cater for populations of mountain grey gum occurring in

western Victoria in the Grampian Ranges and near Anglesea on the Otway coast. More reeently, Johnson and Hill (1990) deseribed *E. volcanica,* a smallish, box-barked tree with orbieular, glaueous juvenile leaves, a basally constrieted opereulum and pedieellate fruits with deeply reeessed valves, and *E. retinens,* a smallish, box-barked, woodland tree with relatively small adult leaves, ovate juvenile leaves and relatively small, obtuse buds. Further, Hunter and Bruhl (1999) deseribed *E. quinniorum,* a mallee-like speeies with relatively small adult leaves and an opereulum that is consistently broader than the hypanthium, and *E. oresbia*, a medium-sized, smooth-barked tree with buds eonstrieted (waisted) at the abseission zone and with relatively small fruits. These speeies oeeur in northern regions of New South Wales on the relatively dry, inland side of the Great Dividing Range where the prevailing conditions do not favour the existenee of *E. cypellocarpa.* In western Victoria, too, *E. alaticaulis* oeeurs on drier, poorer soils than those favoured by *E. cypellocarpa* and appears to have had a similar evolution to these northern taxa.

The present author has reassessed *E. cypellocarpa,* with a partieular foeus on Victorian populations occurring in atypical habitats. A part of this foeus was to examine populations attributed to *E. alaticaulis* whieh Brooker and Slee had included with *E. cypellocarpa.* These investigations have shown the existenee of two entities worthy of recognition as new speeies, eaeh possessing a distinctive eombination of features in both seedling and adult stages. The first, a half-barked, stunted tree, eomprising the Anglesea populations previously ineluded with *E. alaticaulis* by Watson and Ladiges (1987); and the seeond, a small tree, whieh Watson and Ladiges had alluded to as being a part of *E. alaticaulis,* oeeurs at the eastern end of the Pyrenees Range. The investigations also provided suffieient evidenee to support the retention of *E. alaticaulis sens. strict.* (Grampians populations) as a speeies on the bases of appreeiable distinctions in habit, bark, juvenile leaves and adult leaves.

KEY TO MOUNTAIN GREY GUMS

1. Juvenile leaves glaucous ..... *E. volcanica*
1a. Juvenile leaves green 2

2. Buds conspieuously waisted at the abseission zone ..... *E. oresbia*
2a. Buds non-waisted or waisted below the abseission zone 3

3. Trees to 50 m tall ..... *E. cypellocarpa*
3a. Small trees to 20 m tall or mallees 4

4. Buds with hemispherieal or obtuse opereula ..... *E. retinens*
4a. Buds with aeutely eonieal or rostrate opereula 5

5. Buds non-waisted with opereulum wider than the hypanthium ..... *E. quinniorum*
5a. Buds waisted with opereulum narrower than or as wide as the hypanthium 6

6. Pedunele slender, 2–3 mm wide, fruits 5–6 mm long, 5–6 mm diam. ..... ***E. pyrenea***
6a. Pedunele broadly flattened, 3–5 mm wide; fruits 7–13 mm long, 6–11 mm diam. 7

7. Seedling growth tips glaueous; mature opereulum 4–8 mm long; fruits 9–13 mm long, 8–11 mm diam. ..... ***E. litoralis***
7a Seedling growth tips lustrous; mature opereulum 3–4 mm long; fruits 6–10 mm long, 6–9 mm diam. ..... *E. alaticaulis*

1. ***Eucalyptus litoralis*** K. Rule, *sp. nov.*

Eucalypto cypellocarpa affinis habitu minore, cortice persistente buxiforme, foliis juvenalibus latioribus, operculo longiori, fructibus majoribus, et affinis *E. alaticaule* sed foliis juvenalibus pluris sessilibus oppositis, operculo longiori et fructibus majoribus differt.

Type: Victoria, Coalmine Road, Anglesea, *K. Rule 0097*, 10.vii.2000 (holotype: MEL; isotypes: AD, CANB, NSW).

Smallish, robust, sometimes multi-trunked *trees* to 18 m tall. *Bark* box-like, fibrous, thin, grey-brown, persistent, often extending to the upper trunk, less often forming a short basal stocking; upper trunk and branches smooth, light grey or whitish. *Seedling leaves* broadly ovate, opposite, sessile, lightly pruinose; seedling stems lightly pruinose. *Juvenile leaves* broadly ovate, broadly elliptical, cordate, sub-orbicular, sessile, amplexicaul, opposite for numerous pairs, apiculate, 4–8 cm long, 3–6 cm wide; upper surface lustrous, dark green; lower surface pale green; growth tips lightly pruinose, becoming lustrous with maturity; seedling stems glandular, square in cross-section, moderately winged. *Intermediate leaves* broadly ovate or broadly lanceolate, shortly petiolate, disjunct, slightly discolorous, lustrous, dark green. *Adult leaves* broadly lanceolate, falcate, pendulous, acuminate, concolorous, lustrous, green, 18–35 cm long,

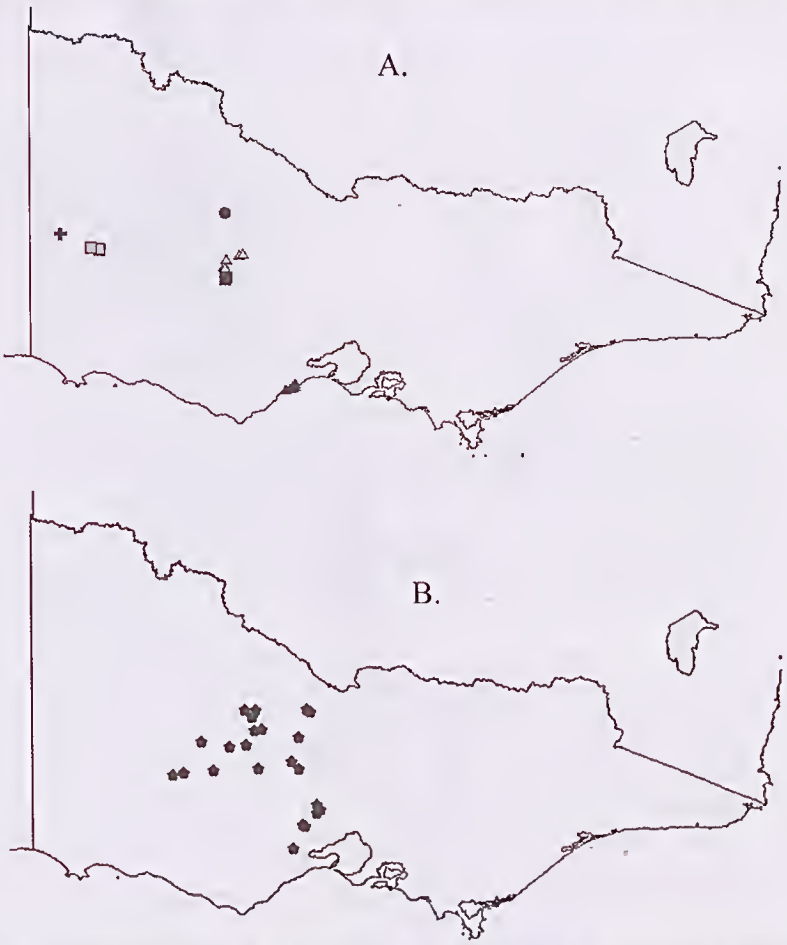

Figure 1. Distribution maps. A. *E. filiformis* ●; *E. hawkeri* □; *E. litoralis* ▲; *E. pyrenea* ■; *E. tricarpa* subsp. △; *E. walshii* +. B. *Eucalyptus polyanthemos* subsp. ⬟

Figure 2. *Eucalyptus litoralis* **a** juvenile leaves; **b** adult leaves; **c** buds; **d** fruit.

2.5–4.5 cm wide; petioles 2.2–4.1 cm long; venation conspicuous, moderately reticulate; intramarginal vein remote, 3–5 mm from margin; oil glands regular, relatively small, scattered, intersectional and island. *Inflorescences* simple, axillary, 7-flowered; peduncles broadly flattened (strap-like), conspicuously ribbed, erect in orientation, 1.3–2.4 cm long, 3–5 mm wide. *Floral buds* sub-urceolate, 10–14 mm long (excluding pedicel), 4–6 mm diam.; pedicels 1–4 mm long; hypanthium ribbed, basally bulging, slightly waisted above or at the mid-point; scar present; operculum conical to rostrate, sometimes narrower than the hypanthium at the abscission zone but usually flush with the hypanthium at anthesis, 4–8 mm long; stamens inflexed; filaments white; anthers oblong, versatile, dorsifixed, dehiscing through longitudinal slits; ovular rows 4; flowering period autumn. *Fruits* cupular or barrel-shaped, thick-walled, basally tapered, smooth or sometimes moderately ribbed, sessile to shortly pedicellate, 9–12(–13) mm long, 8–11 mm diam.; pedicels thick, often indistinct, to 3 mm long; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* dark brown or black, 2–3 mm long, flattened, ovoid, pointed at one end, lacunose; hilum ventral. (Fig. 2).

Etymology: The epithet is derived from the Latin *litoralis* "of the shore" in reference to the coastal distribution of the species.

Distribution and habitat: *Eucalyptus litoralis* occurs along the Otway Coast of Victoria from north-east of Anglesea as far as Airey's Inlet in the south-west, with an outlier occurring close to Lorne (Fig. 1). It favours poor soils on sandstone ridges and slopes which are often exposed to the prevailing ocean winds. The annual rainfall of Anglesea is approximately 800 mm, most of which falls in winter.

Associated species: *E. obliqua* L'Herit., *E. viminalis* Labill. subsp. *viminalis*, *E. aromaphloia* Pryor & Willis, *E. baxteri* (Benth.) Maiden & Blakely, *E. tricarpa* (L.A.S. Johnson) L.A.S. Johnson & K.D. Hill and *E. ovata* Labill. have been observed in association with *E. litoralis* whilst pure stands of *E. willisii* Ladiges, Humphreys & Brooker *sens lat.* occur nearby.

Conservation status: *E. litoralis* is locally abundant but populations close to Anglesea are under threat from housing developments. Some populations are secure within protected reserves including the Angahook-Lorne N.P. A code of 2VCa is recommended in accordance with Briggs and Leigh (1996).

Discussion: Parsons and Kirkpatrick (1972) studied the Anglesea populations in an attempt to determine whether they were hybrids. The authors concluded they were not on the basis of morphological uniformity of seedlings. Watson and Ladiges also recognised the purity of the Anglesea populations but opted to regard them as a minor variant within *E. alaticaulis*. Johnson and Hill (1990) recognised them as being sufficiently distinctive to be regarded as a separate taxon, as did Brooker and Slee (1997). In my opinion Watson and Ladiges' concept of *E. alaticaulis* was too broad and, thus, the Anglesea populations are treated here as a new species.

The seedling stems of *E. litoralis* and its close relatives are square in cross-section (also often winged), the buds are pedicellate and the fruits usually basally tapered and shortly pedicellate. It is considered here somewhat distantly related to *E. goniocalyx*, despite some box-barked forms resembling that taxon in general appearance.

E. litoralis has a similar bark to *E. alaticaulis*, both types being relatively thin, loose, box-like and forming stockings to various heights. However, *E. alaticaulis* has seedlings whose growth tips are non-pruinose in early development and juvenile leaves becoming shortly petiolate and sub-opposite by about the 10th pair. Further, its buds are smaller and have a shorter operculum (3–4 mm long), with the operculum flush with the hypanthium at the abscission zone, and its fruits are smaller (6–10 mm long, 6–9 mm diam.).

Seedling trials of several provenances of *E. cypellocarpa sens. strict.* across its range have revealed that the species has variable seedlings. Seedling stems may be square in

eross-seetion and sometimes moderately winged or just round in eross seetion. Further, the laneeolate juvenile leaves may be strongly amplexieaul or basally obtuse. This may indieate that seedling stem morphology within the mountain grey gums is a less reliable diagnostie indieator than previously thought. Nonetheless, *E. cypellocarpa* can be distinguished from the new speeies by its taller habit (large, straight forest tree to 50 m tall), its smooth bark (plates and chunks of old bark often persisting on the lower trunk), its longer, narrower (laneeolate), aeuminate juvenile leaves, its smaller buds with a shorter opereulum (3–4 mm long) and its smaller fruits (6–10 mm long, 6–9 mm diam.).

E. goniocalyx has been eompared with the Anglesea populations, for example, by Brooker and Slee (1997). Features which distinguish it from the new speeies include its pruinose seedlings with glaueous, orbicular juvenile leaves and mostly round, non-winged stems, its eonsistently smaller adult leaves (to 25 em long, 3 cm wide), its bark whieh is short-fibred, thiek, compact, sometimes erusty box type, extending to the seeondary hranehes, and its smaller, eonsistently sessile buds and fruits.

Additional specimens examined: **VICTORIA**: Eumeralla Scout Camp, near eoastal cliffs, Anglesea, *L. Costermans*, 4.xii.1966 (MEL); Currawong Falls walking traek, 6 km WNW of Anglesea, *A.C. Beauglehole ACB63583*, 19.i.1979 (MEL); Anglesea Road to the west of the sports and recreation camp, *L.A.S. Johnson, K. Wilson & K. Hill 1719*, 10.iii.1986 (MEL); Urquart's Bluff on Great Ocean Road, *K. Rule 0099*, 10.vii.2000 (MEL); 2.3 north-east of Anglesea on the Great Ocean Road, between Forest Road and Coalmine Road, *K. Rule 0202*, 24.i.2002 (MEL); Boundary Road, Aircy's Inlet, e. 700 m from Great Ocean Road, *K. Rule 0200*, 24.i.2002 (MEL); at the end of Ellimatta Road, ENE of Anglesea, *K. Rule 0204*, 24.i.2002 (MEL); Harvey Road, adjacent to the intersection with O'Donahue Road, c. 1 km west of Anglesea, *K. Rule 0205*, 24.i.2002 (MEL).

2. *Eucalyptus pyrenea* K. Rule, *sp. nov.*

Eucalypto cypellocarpa affinis habitu minore, eaulibus plantarum juvenalibus alatis prominentibus, foliis juvenalibus latioribus, elliptieo-ovatis, foliis adulus brevioribus, pedunculis brevioribus, alabastris pedieellatis valde, fructibus minoribus, et affinis *E. alaticaule* sed eortice laeve, sureulis plantularum pruinosis, foliis juvenalibus angustoribus, alabastris pedieellatis valde, fruetibus minoribus differt.

Type: Vietoria, Pyrenees Range, Mt. Avoea, Mountain Hut Road, 6.8 km from the Pyrenees Hwy., *K. Rule 0101*, 19.iv.2001 (holotype: MEL; isotypes: AD, CANB, NSW).

Smallish, often spreading or erect, slender *trees* to 18 m tall. *Bark* light grey, thin, box-like, forming a short stocking to at most mid-trunk, smooth, light grey or off-white above; all or most of the stocking shed in summer in sheets and strips. *Seedling leaves* broadly ovate to elliptical, blue-grey, pruinose, discolorous. *Juvenile leaves* broadly ovate or elliptieal-ovate, sub-erenulate, opposite and sessile for numerous pairs, amplexieaul, apiculate, soft-textured, diseolorous, dull or sub-lustrous, blue-green, 6–13 em long, 5–9 em wide; seedling stems pruinose, glandular, square in eross-section, prominently winged; growth tips pruinose; advanced juvenile leaves petiolate, disjunct, eoarse-textured, lustrous, dark blue-green. *Intermediate leaves* ovate or ovate-laneeolate, shortly petiolate, disjunet, slightly diseolorous, lustrous, green. *Adult leaves* laneeolate, sometimes faleate, petiolate, pendulous, aeuminate, concolorous, lustrous, green, 12–25 em long, 2–3.4 em wide; petioles 1.8–2.9 em long; venation moderately retieulate; intramarginal vein relatively remote, 2–3 mm from the margin; oil glands regular, scattered, island or interseetional. *Inflorescences* simple, axillary, 7-flowered; peduncles relatively slender, flattened, often becoming slightly angled in the fruit stage, 2–3 mm wide, 10–16 mm long. *Floral buds* ovoid-eylindrieal, sometimes slightly waisted at mid-point, 6–8 mm long (exeluding pedieel), 3–4 mm diam., often faintly ribbed; sear present; pedieels 5–8 mm long; opereulum conieal, 3–4 mm long, as wide as the hypanthium at the abscission zone; stamens inflexed; filaments white, all fertile; anthers

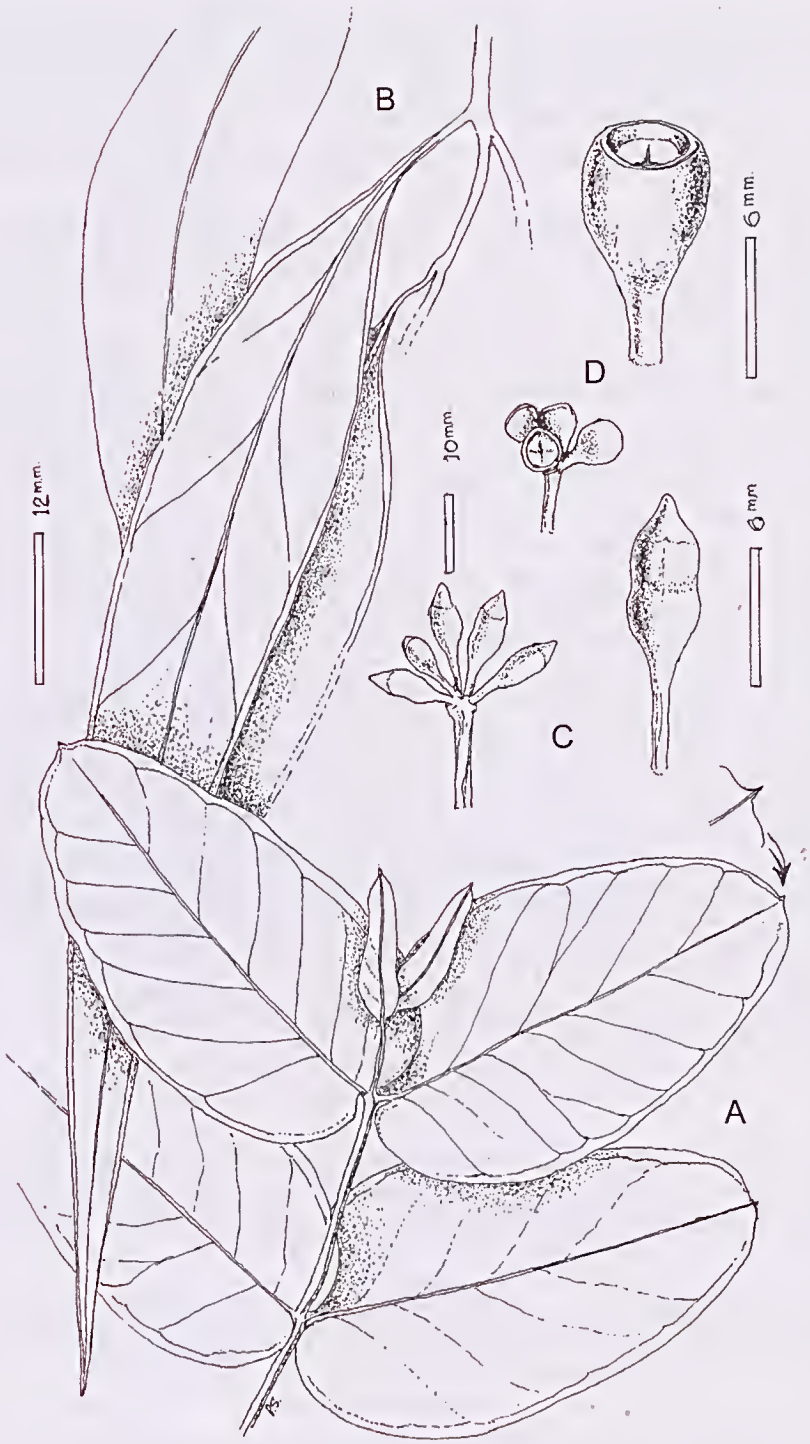

Figure 3. *Eucalyptus pyrenea* **a** juvenile leaves; **b** adult leaves; **c** buds; **d** fruit.

oblong, versatile, dorsifixed, dehiscing through longitudinal slits; ovular rows 4; flowering period autumn. *Fruits* cupular, thick-walled, smooth or faintly ribbed, basally tapered, 5–6 mm long, 4–6 mm diam.; pedicels 3–6 mm long; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* dark brown or black, c. 2 mm long, flattened, ovoid, pointed at one end, lacunose; hilum ventral. (Fig. 3).

Etymology: The epithet refers to the species' location which is the Pyrenees Range of west-central Victoria.

Distribution and habitat: The species is known only from Mt. Avoca at the eastern end of the Pyrenees Range in west-central Victoria (Fig. 1). It grows in shallow soils on dry rocky slopes at an altitude of above 600 m. The annual rainfall of the area is approximately 600 mm, most of which falls in winter.

Associated species: *E. aromaphloia* Pryor & Willis and *E. macrorhyncha* F. Muell. ex Benth., *E. bicostata* Maiden, Blakely & Simmonds, *E. nortonii* (Blakely) L.A.S. Johnson, *E. obliqua* L'Herit., *E. radiata* Sieb. ex DC. and *E. dalrympleana* Maiden occur with or adjacent to the new species. The Pyrenees Range is isolated from the occurrences of the new species' nearest relatives, *E. cypellocarpa* L.A.S. Johnson and *E. alaticaulis* R.J. Watson & Ladiges.

Conservation status: The species is relatively abundant across its range. Although in the Avoca S. F., it is considered vulnerable, especially to timber harvesting. In accordance with Briggs and Leigh (1996) a code of 2V is suggested as the current management regime of state forests offers no guarantee of long term protection.

Discussion: Watson and Ladiges (1987) noted that the form occurring in the Pyrenees Range has juvenile leaves similar to *E. alaticaulis* and alluded to it as an outlier of that species. Brooker and Slee (1997) included it within *E. cypellocarpa*. My investigations, including seedling trials and field studies, indicate that this form is distinctive within the mountain grey gum complex by the combination of the following features; a smallish tree habit; smooth summer bark and a light grey, thin, box-like stocking of winter bark; broadly elliptical-ovate or ovate, bluish and later lustrous, blue-green juvenile leaves; squared, prominently winged seedling stems; relatively small adult leaves; narrow, angled or flattened peduncles (particularly in the fruit stage); distinctly pedicellate buds; and relatively small fruits. However, it possesses slightly waisted buds which is a distinguishing feature of the group.

E. cypellocarpa differs from the new species by its seedling stems never being prominently winged, its lanceolate, acuminate juvenile leaves, its taller habit, its bark, which does not feature the seasonal box-like stocking, its longer peduncles (1.3–2.4 cm long), its generally larger fruits (6–9 mm long, 6–8 mm diam.) and its longer adult leaves (to 35 cm long).

E. alaticaulis is distinguished from the new species by its variable habit (robust mallees, small, spreading trees or slender, medium-sized trees), its non-pruinose seedling stems and growth tips, its sub-orbicular or orbicular juvenile leaves, which become petiolate in early development, its broader, more strap-like peduncles (3–5 mm wide) and its larger fruits (fruits 6–10 mm long, 6–9 mm diam.).

Additional specimens examined: **VICTORIA**: Pyrenees S. F. No 2 Creek Road, *R.J. & Y.A. Bishop*, 6.xi.1982 (MEL); Mount Avoca Road 1.2 km from lookout, *K. Rule 00103*, 20.viii.2000; Mountain Hut Road, 7 km from Pyrenees Highway, *K. Rule 0102*, 19.iv.2001 (MEL).

SECTION *ADNATARIA*: SERIES *SUBBUXEALES*: THE MALLEE-BOXES

Recent surveys of the Wimmera region of Victoria have yielded several very restricted, unnamed, true-breeding eucalypts. Many are mallee-boxes, three of which are treated here as new species. The pitiful numbers of some of their populations epitomise the plight

of the native flora in this part of Victoria where extensive tracts of land have been cleared for agriculture. What is left of the native vegetation outside protected reserves consists of small remnants on roadsides and farms. These discoveries suggest that a richer diversity of eucalyptus species existed in this part of the state than was previously thought.

Brooker and Kleinig (1990) noted the importance of leaf venation as a tool to segregate Western Australian taxa into natural groups, particularly at the series level. For example, *E. eremophila* (Diels) Maiden and its allies have leaves without visible lateral veins (apparently obscured by excessively crowded oil glands), while *E. occidentalis* Endl. and its allies feature conspicuously reticulate venation. They also isolated *E. piupiuiana* Maiden into a monospecific series because of its distinctive venation and oil gland patterns.

Traditionally the mallee-boxes have formed the series *Subbuxeales* Blakely but were included within the series *Molucanae* Blakely by Brooker (2000) in his reassessment of the eastern boxes. That author used venation patterns to support the segregation of *E. froggattii* Blakely and *E. porosa* F. Muell. ex Miq. into separate monospecific "supraspecies" (subseries). While both *E. froggattii* and *E. porosa* have numerous island glands and a remote intramarginal vein, the former has faint lateral veins which do not intersect with the mid-vein while the latter has conspicuous, widely spaced, unbroken lateral veins.

Within the other the mallee-boxes adult leaves exhibit a variety of venation types and oil gland patterns which not only permit the further identification of some natural groups but serve as useful taxonomic tools. *E. odorata* Behr ex Schlecht., *E. polybractea* R.T. Baker, *E. wimmereusis* K. Rule, *E. aenea* K.D. Hill, *E. castreusis* K.D. Hill and *E. filiformis* K. Rule sp. nov. (described below), for example, have moderately reticulate adult leaves with visible lateral veins, widely-spaced, veinlets and numerous, to sparsely relatively large, irregular island glands. *E. viridis* R.T. Baker is somewhat distinctive by its sparsely reticulate adult leaves, whose lateral veins are obscured or faint and often not intersecting with the intramarginal vein, its lack of veinlets and its relatively large, sometimes indistinct island glands. The somewhat contentious *E. silvestris* K. Rule and the recently described *E. albopurpurea* (Boomsma) Nicolle (formerly *E. lansdowneana* F. Muell. & J.E. Brown subsp. *albopurpurea* Boomsma) have densely reticulate adult leaves with conspicuous lateral veins, crowded, relatively thick veinlets and scattered, variously-sized, irregular intersectional glands, In contrast, *E. hawkeri* K. Rule sp. nov. and *E. walshii* K. Rule sp. nov. (both described below) have densely reticulate adult leaves with crowded, faint, often broken veinlets and numerous, relatively large island and intersectional oil glands. For comparisons of other features of the mallee-boxes see Table 1.

1. *Eucalyptus hawkeri* K. Rule, *sp. nov.*

Eucalypto odoratae affinis foliis adultis nitentioribus olivaceis pendulis reticulatis dense et fructibus minore differt, et *Eucalypto walshii* affinis habitu elatiore, cortice persistente buxiforme, foliis adultis nitentioribus olivaceis pendulis et fructibus elongatioribus differt.

Type: Victoria, Mt. Arapiles, the southern access track, near the intersection with the south-western access track, *K. Rule 0219 & P. Hawker*, 6.iv.2002 (holotype: MEL; isotypes: AD. CANB, NSW).

Slender *mallees* or *trees* to 15 m tall, old trees sometimes umbrageous or decumbent. *Bark* dark grey-brown, box type, persistent as a stocking extending to at least mid-trunk, smooth, light grey to red-brown above; old bark decorticating in broad strips. *Seedling leaves* narrowly elliptical, petiolate, opposite for 3 or 4 pairs, blue-green, discolorous. *Juvenile leaves* narrowly lanceolate, lanceolate or narrowly elliptical, rarely falcate, alternate, petiolate, dull, blue-green or sub-glaucous, slightly discolorous, 6–12 cm long,

Table 1. Features of mallee box

Eucalyptus	*odorata*	*polybractea*	*wimmerensis*	*aenea*	*castrensis*	*filiformis*
HABIT	Large mallee or small, spreading tree	Mallee, rarely slender tree	Mallee	Slender, small mallee	Malles or slender, small tree	Semi-effuse mallee
BARK	Box type over most of the trunk	Smooth or with variable box type stocking	Smooth or with box type basal stocking	Smooth	Smooth, often with short box type basal stocking	Box type to major branches
JUVENILE LEAVES Size (length x width, cm)	6–10 x 1.5–2.6	5–10 x 1.0–1.5	4–8 x 1.0–1.6	5–8 x 0.7– 1.8	6–12 x 1.5–4	5–10 x 0.2–0.4
Colour/lustre	Dull, blue-green, rarely faintly pruinose	Dull, glaucous or blue-green	Dull, blue-green or sub-glaucous	Dull, blue-green	Dull, blue-green	Dull, blue-green or sub-glaucous
Petiole length (cm)	To 1.0	To 1.0	To 1.2	To 1.0	To 1.4	To 0.4
ADULT LEAVES Size (length x width, cm)	6–12 x 1.2–2.0	5–9 x 1.0–1.7	5–8 x 1.0–1.5	5–11 x 0.9– 1.8	6–13 x 0.8–2.2	5-8 x 0.7-1.1
Colour/lustre	Dull, or sub-lustrous, blue-green, olive-green or rarely sub-glaucous	Dull, glaucous or sub-glaucous	Sub-lustrous or lustrous, blue-green or green	Lustrous, light-green	Lustrous, green	Dull, or sub-lustrous
Petiole length (cm)	To 1.5	To 1.5	To 1.3	To 1.0	To 1.5	To 1.2
Intramarginal vein (mm from margin)	1-2	c. 1	c. 1	c. 1	1 –2	c. 1
INFLORES-CENCES	Simple, axillary	Simple, axillary	Simple, axillary	Simple, axillary, rarely paniculate	Simple, axillary	Simple, axillary
Peduncle length (cm)	0.4–1.2	0.4-1.0	0.5-1.3	0.4-0.7	0.7-1.0	0.7-1.0
BUDS Shape	Clavate or slightly diamond-shaped, sometimes angular	Clavate or ovoid	Ovoid or slightly clavate	Ovoid	Ovoid	Ovoid-fusiform
Size (length x width, mm)	6–8 x 4–5	5–6 x 3–4	5–6 x 3–4	4–6 x 2–3	5–6 x 2-3	6-8 x 3-4
Pedicel length (mm)	2–5	4–7	4–6	1–3	2–4	4-6
Pruinosity	Absent	Present	Absent or rarely faint	Absent	Absent	Present
FRUITS Shape	Cupular or barrel-shaped, often basally angled	Cupular, barrel-shaped or sub-cylindrical	Suh-cylindrical or cupular	Cupular	Cupular	Suh-cylindrical or barrel-shaped
Size (length x width, mm)	5–8 x 4–6	5–6 x 4–5	4 -6 x 4–6	3–5 x 3–5	4–5 x 4–6	6-9 x 4-5
Pedicel length (mm)	1–4	3–5	2–4	1–3	1–4	3-5

viridis	*hawkeri*	*walshii*	*silvestris*	*albopurperea*	*porosa*	*froggattii*
Mallee or small, slender tree	Mallee or slender tree	Slender tree	Large mallee or small spreading tree	Mallee or small tree	Large, spreading mallee or small tree	Mallee or slender tree
Box type stocking to upper stem	Box type stocking to upper trunk	Smooth with basal box type stocking	Box type to at least major branches	Usually box type stocking	Box type to secondary braneches	Smooth with short basal box type stocking
4–10 x 0.4–0.8	6–12 x 1.0–1.8	5–10 x 1.2–2.3	5–8 x 1.4–3.2	4 –7 x 1.0–3.0	5–9 x 2.5–3.6	5–9 x 1.8–2.8
Lustrous, green	Dull, blue-green	Dull, blue-green	Dull, blue-green	Lustrous, green	Dull, blue-green	Lustrous, green
To 0.2	To 1.2	To 1.0	To 1.2	To 1.2	To 1.3	To 1.0
5–8 x 0.6–0.8	7–12 x 0.8–1.7	7–10 x 1.4–2.6	6–10 x 1.2–2.2	6–2 x 2.0–3.5	7–12 x 1.3–1.9	6–12 x 1.0–1.8
Lustrous, dark green	Lustrous, olive-green	Dull or sub-lustrous, blue-green	Sub-lustrous or lustrous green or olive-green	Lustrous, green	Lustrous, green	Lustrous, green
To 0.6	To 1.6	To 1.4	To 1.4	To 1.4	To 1.4	To 1.5
e. 1	e.1	e. 2	e. 2	e. 2	2– 3	2-3
Simple, axillary or rarely paniculate	Simple, axillary	Simple, axillary	Simple axillary	Simple, axillary and panieulate	Simple, axillary	Simple, axillary and panieulate
0.5–0.9	0.7–1.1	0.7–1.1	0.7–1.0	1.0–1.4	0.4–1.1	0.7–1.4
Ovoid or fusiform	Ovoid or fusiform	Ovoid-fusiform	Ovoid or slightly clavate	Clavate, ovoid or fusiform, often basally angular	Clavate or ovoid	Clavate or ovoid, quadrangular
4–5 x 2–3	6-7 x 3-4	5-7 x 3-	5–6 x 3 – 4	7-11 x 3-5	5-8 x 3-4	7-10 x 4-5
4–6	4–8	2–4	4–6	0–3	3–5	3–5
Absent	Absent	Absent	Absent	Absent	Absent	Absent
Cupular or hemispherical	Cylindrical, sub-eylindrieal or barrel -shaped	Cupular	Obconical, eupular or sub-eylindrical	Barrel-shaped to cupular, often basally angular	Barrel-shaped or eupular	Cupular or sub-eylindrieal, quadrangular
3–5 x 3–4	6–7 x 3–5	5-6 x 4–5	4–6 x 3–4	6–10 x 6–9	5–7 x 5–6	8–10 x 6–8
3–5	3–6	1–3	3–5	0–3	3–5	2–4

1.0–1.8 cm wide; nodes widely spaced; petioles 0.6–1.2 cm long. *Intermediate leaves* lanceolate, sometimes falcate, pendulous, concolorous, slightly broader than the juvenile leaves. *Adult leaves* narrowly lanceolate or lanceolate, sometimes falcate, pendulous, acuminate, uncinate, glandular, lustrous, olive-green, becoming slightly bluish in winter, 7–12 cm long, 0.8–1.7 cm wide; petioles terete, 1.0–1.6 cm long; venation moderately acute (35–50 degrees), densely reticulate (conspicuous lateral veins and semi-crowded faint veinlets forming small areoles); intramarginal vein c. 1 mm from the margin; oil glands large, numerous, irregular, island and intersectional. *Branchlets* often lustrous, red-brown. *Inflorescences* simple, axillary, 7–11-flowered, along the main axis or along terminal, leafy branchlets; peduncles angular or terete, slender, 0.7–1.1 cm long. *Floral buds* ovoid or fusiform, unscarred (outer operculum intact), often lustrous, red-brown, 6–7 mm long, 3–4 mm wide; operculum conical, c. half the length of the hypanthium; pedicels slender, 4–8 mm long; filaments white; stamens irregularly inflexed, all fertile; anthers adnate, basifixed, globular, dehiscing through lateral pores; ovules in 4 vertical rows; flowering period autumn. *Fruits* sub-cylindrical, cylindrical or barrel-shaped, basally tapered, lustrous, red-brown, 6–7 mm long, 3–4(–5) mm diam.; pedicels slender, 3–6 mm long; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* ovoid, slightly flattened, finely reticulate, dark brown; hilum ventral. (Figs 4, 7).

Etymology: The epithet honours Mr Peter Hawker of Natimuk, the current park ranger of the Mt. Arapiles-Tooan State Park, and recognises his significant contributions to the understanding of this new species and of several other rare eucalypts of the Wimmera region.

Distribution and habitat: *E. hawkeri* is known only from the Mt. Arapiles area in the southern Wimmera where it is scattered around the northern, south-western and southern bases of the mountain. A small outlier population occurs at Jane Duff Reserve, approximately 8 km to the west of Mt. Arapiles (Fig. 1). It occurs on shallow, often gravely soils derived from lateritic sandstone bedrock. The annual rainfall of nearby Horsham is approximately 500 mm, most of which falls in winter.

Associated species: The new species occurs in pure stands and forms woodland communities with *E. leucoxylon* F. Muell. subsp. *stephaniae* K. Rule and *E. microcarpa* Maiden and abuts stands of *E. largiflorens* F. Muell. when adjacent to poorly drained, lower sites. It also occurs in mallee communities where it mixes with variants of *E. wimmerensis*, *E. phenax* Brooker & Slee, *E. costata* F. Muell. subsp. *murrayana*, L.A.S. Johnson & K.D. Hill, *E. macmahonii* K. Rule and *E. leptophylla*. F. Muell. ex Miq. In the Mitre Rock area, less than a kilometre to the north of Mt. Arapiles, there is evidence of substantial interbreeding between *E. hawkeri* and *E. microcarpa*. Previously (1990) the current author had interpreted these as hybrids between *E. microcarpa* and *E. wimmerensis*. Other hybrids have been identified around the northern and the north-eastern bases and near the south-western corner of the reserve.

Conservation status: *E. hawkeri* is relatively abundant around the northern, north-western, western and south-western bases of Mt. Arapiles. The survival of these stands appears secure with the park's current management regime. However, the few stands and individuals which exist outside the park may be vulnerable to further clearing. In accordance with Briggs and Leigh (1996) a code of 2RCa is recommended.

Discussion: *E. hawkeri* is distinguished within the mallee-boxes by its tallish mallee or slender tree-like habit, its substantial stocking of box bark, its relatively narrow, bluish juvenile leaves, its narrowly lanceolate, pendulous, densely reticulate, lustrous, olive-green adult leaves and its smallish, sub-cylindrical, cylindrical or barrel-shaped fruits.

E. walshii is tentatively placed adjacent to *E. hawkeri* on the basis of the two having adult leaves with a similarly dense reticulation. *E. walshii*, however, is different by its smaller, more slender habit, its smooth, seasonally whitish bark, its broader, bluish, sub-lustrous adult leaves and its cupular fruits.

Figure 4. *Eucalyptus hawkeri* **a** juvenile leaves; **b** adult leaves and fruits; **c** buds; **d** fruits.

There are some similarities between the South Australian taxon, *E. odorata,* and *E. hawkeri* in habit and bark but they are different in leaf morphology. In particular, the adult leaves of *E. odorata* are generally larger (to 12 cm long, 2 cm wide), semi-rigid, duller, and moderately reticulate. Also, during growth spurts, its canopy becomes appreciably sub-glaucous whereas the canopy of *E. hawkeri* is appreciably lustrous. It is further distinguished from *E. hawkeri* by its generally larger fruits (5–8 mm long, 4–6 mm diam.).

E. silvestris is a mallee-box of the Wimmera region which also features box bark, simple, axillary inflorescences and smallish buds and fruits. However, it is separable from *E. hawkeri* by its often depauperate habit, its more extensive box bark, which extends to the major branches, and its adult leaves which are different in venation and oil gland patterns. As well, the winter foliage of *E. silvestris* becomes appreciably dull whilst that of *E. hawkeri* remains lustrous and *E. silvestris* has broader, shorter juvenile leaves (to 8 cm long, 3 cm wide). Further, *E. silvestris* has a more northerly distribution where it occurs on dry, loamy rises in the northern Wimmera.

E. microcarpa is also a common box-barked tree in the Mt. Arapiles area, particularly adjacent to its eastern and south-eastern slopes. However, that species can be distinguished from *E. hawkeri* by its taller habit, its usually lighter, more compact bark, its broader juvenile leaves (3.5–9.0 cm wide) and its duller, broader adult leaves (1.8–3.5 cm wide), with venation and oil gland patterns similar to *E. silvestris and E. albopurpurea,* and its paniculate inflorescences.

Additional specimens examined: **VICTORIA***:* Mt. Arapiles, along the northern access road, c. 500 m from the north-eastern entrance, *K. Rule 9537*, 9.iv.1995 (MEL); 1.5 km north of the Mt. Arapiles camping ground, *K. Rule 9615 & P. Hawker*, 9.ii.1996 (MEL); the southern access track, on the southern side of Mt. Arapiles, *K. Rule 9856 & P. Hawker*, 28.ix.1998 (MEL); adjacent to the transmitting tower on the north-western slope of Mt. Arapiles, *K. Rule 9858*, 28.ix.1998 (MEL); 1.6 km north of the Mt. Arapiles camping ground, *K. Rule 0004*, 10.iv.2000 (MEL); North-east entrance to Mt. Arapiles Park, *K. Rule 0015*, 10.iv.2000 (MEL); Jane Duff Reserve, *K. Rule 0232 & P. Hawker*, 5.iv.2002 (MEL).

2. *Eucalyptus walshii* K Rule *sp. nov.*

Eucalypto odoratae affinis habitu minore, cortice laeve niveo, foliis adultis reticulatis dense et fructibus minore differt, et *Eucalypto hawkeri* affinis habitu minore, cortice laeve niveo, foliis adultis latioribus impolitis et fructibus cupularibus differt.

Type: Victoria, c. 400 m north of Broughton's Waterhole, Little Desert, *K. Rule 0231 & P. Hawker*, 5.iv.2002 (holotype: MEL; isotypes: AD, CANB, NSW).

Small, slender, pole-like, *trees*, 4–9 m tall. *Bark* smooth, whitish in summer, light grey in winter; old bark pale, grey-brown, decorticating in thin strips and plates; basal bark box-like, forming a short stocking of < 1 m high. *Seedling leaves* narrowly elliptical, opposite for a few pairs, discolorous, pale green. *Juvenile leaves* elliptical-lanceolate or narrowly lanceolate, disjunct, petiolate, acuminate, dull, blue-grey, becoming lightly pruinose with age, slightly discolorous, 5–10 cm long, 1.2–2.3 cm wide; petioles 0.5–1.0 cm long. *Intermediate leaves* ovate-lanceolate, dull, blue-green, slightly broader than the juvenile leaves. *Adult leaves* lanceolate or ovate-lanceolate, acuminate, uncinate, sub-lustrous, blue-green, 7–10 cm long, 1.4–2.6 cm wide; petioles 0.8–1.4 cm long; venation moderately acute (35–50 degrees), densely reticulate (conspicuous lateral veins and a semi-crowded network of faint veinlets); intramarginal vein 2mm from the margin; oil glands numerous, irregular, island and interseetional. *Inflorescences* simple, axillary, 7–11-flowered; peduncles angular, 0.7–1.1 cm long. *Floral buds* ovoid-fusiform, non-scarred (outer operculum intact), 5–7 mm, long, 3–4 mm diam.; pedicels 2–4 mm long; operculum shortly conical, as wide as hypanthium, 3–4 mm long; stamens regularly inflexed, all fertile; filaments white; anthers adnate, globoid, basifixed, dehiscing through lateral pores; ovules in 4 vertical rows;

Figure 5. *Eucalyptus walshii* **a** juvenile leaves; **b** adult leaves, buds and fruit; **c** buds; **d** fruits.

flowering period autumn. *Fruits* cupular, 5–6 mm long, 4–5 mm diam.; pedicels 1–3 mm long; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* irregular-oblong, brown, finely reticulate; hilum ventral. (Figs 5, 7).

Etymology: The name honours Mr. Neville Walsh of the National Herbarium of Victoria for his monumental contributions to the understanding of Victoria's native flora.

Distribution and habitat: *E. walshii* is known only from a single population growing in siliceous sands on the north side of a low hill near Broughton's Waterhole in the central section of the Little Desert N.P. in Victoria's Wimmera region (Fig. 1). The annual rainfall of nearby Nhill is approximately 400 mm, most of which falls in winter.

Associated species: The new species grows with *E. wimmerensis* whilst *E. costata* subsp. *murrayana*, *E. areuacea* Marginson & Ladiges and *E. leucoxylon* F. Muell. subsp. *pruinosa* (F. Muell. ex Miq.) Boland occur in the immediate vicinity. *E. sabulosa* K. Rule and *E. leptophylla* also occur in the area.

Conservation status: The known number of mature trees, saplings and seedlings is 36. Despite occurring within the Little Desert N.P., the population is by no means secure due to its size. Searches of the immediate area have located no other populations. However, it is possible that other populations exist, given the vastness of the Little Desert. In accordance with Briggs and Leigh (1996) a status of 2E is recommended.

Discussion: *E. odorata* is type species for the Series *Subbuxeales* Blakely to which *E. walshii* belongs. However, that species is readily distinguished from *E. walshii* by its usually larger habit, its persistent box bark, its moderately reticulate adult leaves and its generally larger fruits (5–8 mm long, 4–6 mm diam.).

When first discovered in 1997 the new species was thought to be a relative of *E. albopurpurea* on the basis of its relatively broad adult leaves. However, that species has a different leaf venation and has paniculate inflorescences. *E. albopurpurea* is further different by its generally larger, more robust habit, its box type bark, which can extend over most of the trunk, its angled, more elongated buds and its larger, often angled fruits (6–10 mm long, 6–9 mm diam.).

E. walshii is tentatively placed with the newly described *E. hawkeri* on the basis of their similar adult leaf venation and oil gland patterns. However, that species is different by its taller habit, its long stocking of persistent box bark, its narrower, more lustrous, greener, pendulous adult leaves and its generally narrower fruits. Further, *E. hawkeri* occurs on gravely soils and not siliceous sands.

E. wimmerensis, a common mallee-box throughout the Little Desert, is not readily confused with the new species. Although both species have similar juvenile leaves (in size, shape and colour) and a bluish tinge to the canopy, *E. wimmerensis* differs from the new species by its mallee habit with many stems arising from the lignotuber, its grey or brown rather than whitish bark, and its narrower (1.0–1.6 cm wide), greener and moderately reticulate adult leaves.

Additional specimens examined: **VICTORIA**: c. 400 m north of Broughton's Waterhole, Little Desert N.P., *K. Rule 97139*, 14.ix.1997 (MEL); c. 400 m north of Broughton's Waterhole, Little Desert N.P., *K. Rule 9866 & P. Hawker*, 29.ix.1998 (MEL).

3. *Eucalyptus filiformis* K Rule *sp. nov.*

Eucalypto viridio affinis plantulis et foliis repullulantibus, foliis adultis reticulatis moderate et fructibus subcylindricis differt.

Type: Victoria, Southern slope of Mt Jeffcott, *K. Rule 9933*, 8.vi.1999 (MEL: holotype).

Semi-effuse, lignotuberous *mallees* to 6 m tall. *Bark* box-like, light grey, extending to the upper branches. *Seedling leaves* linear, sessile, opposite for a few pairs, slightly

Figure 6. *Eucalyptus filiformis* **a** juvenile leaves; **b** adult leaves and buds; **c** buds; **d** fruit.

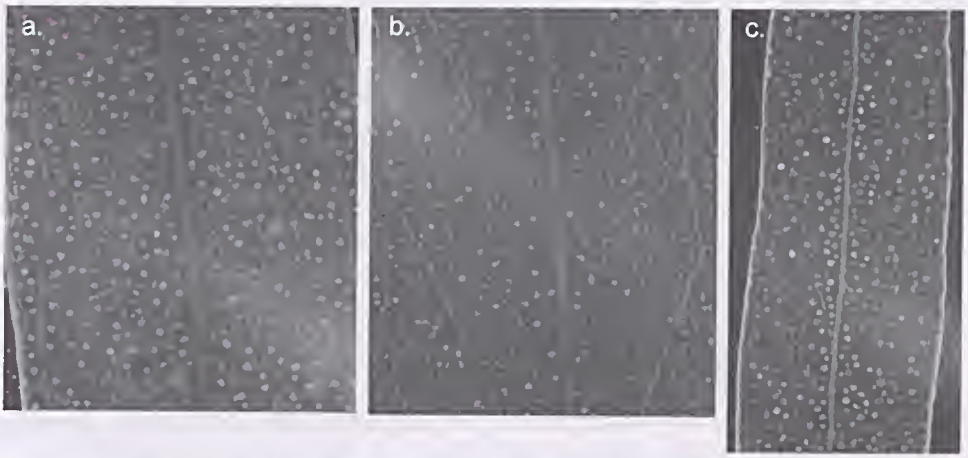

Figure 7. Leaf showing venation and oil glands **a** *E. hawkeri*; **b** *E. walshii*; **c** *Eucalyptus filiformis*.

discolorous, green; nodes crowded. *Juvenile leaves* filiform, broadening in advanced juvenility, crowded, sub-sessile for numerous pairs, disjunct, acuminate, faintly discolorous, blue-green, becoming blue-grey and lightly pruinose with age, 5–10 cm long, 0.2-0.4 cm wide; 0.1-0.4 cm long. *Intermediate leaves* linear-elliptical, shortly petiolate, blue-grey, lightly pruinose. *Coppice leaves* linear-elliptical, crowded, pruinose. *Adult leaves* narrowly lanceolate or narrowly elliptical, crowded, acuminate, uncinate, concolorous, sub-lustrous in summer, dull in winter, blue-green, 5–8 cm long, 0.7–1.1 cm wide; petioles 0.8–1.2 cm long; venation moderately acute (35–45 degrees), moderately reticulate with faintly visible lateral veins extending to the intramarginal vein; veinlets faint; intramarginal vein c. 1 mm from the margin; oil glands numerous, relatively large, irregular, mostly island. *Inflorescences* simple, axillary, 7(–11)-flowered; peduncles slender, angular, 8–10 mm long. *Floral buds* ovoid-fusiform, pruinose, unscarred (outer operculum intact), 6–8 mm long, 3–4 mm diam.; pedicels 4–6 mm long; operculum conical, c. 3 mm long; stamens irregularly inflexed, all fertile, filaments white; anthers adnate, basifixed, globoid, dehiscing through lateral pores; ovules in 4 vertical rows; flowering period late autumn. *Fruit* sub-cylindrical to barrel-shaped, basally tapered, thin-walled, brown, 6–9 mm long, 4–5 mm diam.; pedicels 3–5 mm long; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* irregularly ovoid, dark brown, shallowly reticulate, c. 1 mm long; hilum ventral. (Figs 6, 7).

Etymology: The epithet is derived from the Latin *filum* "thread" and *forma* "shape" in reference to the extremely narrow juvenile leaves of the new species.

Distribution and habitat: The known clump of *E. filiformis* occurs on the private property on the southern slope of Mt Jeffcott in shallow red soils over a sandstone bedrock. Mt Jeffcott, which is about 20 km to the west of Charlton on the edge of the Wimmera region, marks the southern extremity of the Jeffcott Range (Fig. 1). The annual rainfall of the area is about 450 mm, most of which falls in winter.

Associated species: *E. filiformis* occurs as an under-storey species in a remnant woodland community dominated by *E. leucoxylon* subsp. *pruinosa*. *Eucalyptus porosa* and *E. microcarpa* occur nearby, as does a single, smooth-barked, whipstick mallee with similar adult leaves to the new species. This mallee, which is a suspected hybrid with *E. filiformis* as one of the parents, in the four years it has been under observation, has not produced seeds.

Conservation status: Reliable information provided by local naturalists and others indicates that the new species exists only at the type locality. The owners of the property, the Mortlock family of Dunolly have expressed concern for the survival of the species

and its small numbers offer no certainty in the long term. In accordance with Briggs and Leigh (1996) a code of 2E is recommended.

Discussion: *E. filiformis* is distinguished within the mallee-boxes by its smallish, semi-effuse habit, its persistent, light grey box bark, its filiform, crowded, sub-sessile, lightly pruinose juvenile leaves, its bluish adult leaves, its pruinose buds and its sub-cylindrical to barrel-shaped, thin-walled fruits. It shares features with both *E. viridis* and *E. polybractea* but is regarded here as having a taxonomic position closer to the former.

E. viridis is similar by its appreciably narrow, sub-sessile, crowded juvenile leaves. However, it differs by its lustrous, green leaves at all stages (the adult leaves in particular exhibiting obscured venation), its green buds and its smaller, hemispherical or cupular fruits (3–5 mm long, 3–4 mm diam.) which are green when immature.

The pruinose features of *E. filiformis* suggest an affinity with *E. polybractea* which is a common species of mallee-box communities of north and west-central Victoria. However, it differs from the new species by its seasonally smooth bark (accumulated box bark is shed in summer), its broader, distinctly petiolate, less crowded juvenile leaves (in *E. polybractea* to 1.5 cm wide and petioles to 1.0 cm long), its broader adult leaves (1.0–1.7 cm wide) and its relatively thick-walled fruits.

The mallees of *E. filiformis* exhibit uniformity in most features, as do their seedlings raised in seedling trials. However, there is slight variation in leaf length and width between but not within the seedlings raised from the sampled seedlots, which suggests that they may not be derived vegetatively from a single clone like the equally rare *E. recurva* Crisp from near Braidwood in south-eastern New South Wales.

Additional specimens examined: **VICTORIA**: southern slope of Mt Jeffcott, *K. Rule 9849*, 29.ix.1998 (MEL); southern slope of Mt Jeffcott, *K. Rule 0046*, 27.vi.2000 (MEL).

SERIES *MELLIODORAE*: THREE-FLOWERED IRONBARK

The new taxon treated here is a markedly pruinose form of three-flowered ironbark, *Eucalyptus tricarpa* (L.A.S. Johnson) L.A.S. Johnson & K.D. Hill, which occurs in the St Arnaud district and which is here described as a new subspecies.

KEY TO THE SUBSPECIES OF *E. tricarpa*

1. All structures non-pruinose; adult leaves blue-green or green.....subsp. *tricarpa*
1a. Seedlings, branchlets, petioles and buds copiously pruinose; adult leaves greyish.....subsp. ***decora***

Eucalyptus tricarpa (L.A.S. Johnson) L.A.S. Johnson & K.D. Hill subsp. ***decora*** K. Rule *subsp. nov.*

A subspecie typical foliis juvenalibus angustioribus pruinosis, petiolis ramulis et alabastris pruinosis copiose differt.

Type: Victoria, Sunraysia Highway, 42.4 km south of the southern round-about, St Arnaud, *K. Rule 0250*, 10.v.2002 (holotype: MEL; isotypes: AD, CANB, NSW).

Smallish *trees* to 15 m tall. *Bark* grey to dark grey, impregnated with kino (ironbark type), deeply furrowed, extending to minor branches. *Juvenile leaves* linear-elliptical or narrowly elliptical, often falcate, disjunct, shortly petiolate, apiculate, concolorous, pruinose, blue-grey, 5–9 cm long, 0.5–1.1 cm wide; petioles pruinose; stems pruinose. *Intermediate leaves* lanceolate, narrowly ovate or ovate, pruinose; branchlets pruinose. *Adult leaves* lanceolate, acuminate, pruinose, slate-grey, 11–17 cm long, 1.2–2 cm wide; venation moderately reticulate; lateral veins visible, c. 45 degrees to the mid-vein; intramarginal vein, c. 2 mm from the margin; oil glands small, regular, scattered, island. *Inflorescences* simple, axillary,

3-flowered; peduncles slender, terete or angled, 1–2.2 cm long. *Floral buds* clavate or ovoid, prominently 4-ribbed, pedicellate, unscarred (outer operculum intact), conspicuously pruinose, 12–15 mm long, 5–8 mm diam.; pedicels c. twice as long as buds; hypanthium, tapering into the pedicel; operculum conical or rostrate, narrower than the hypanthium, 6–9 mm long; stamens irregularly inflexed; outer whorls infertile; filaments white, cream or pink; anthers adnate, basifixed, angled in relation to the axis, cuboid, dehiscing through terminal pores; ovules in 4 vertical rows; flowering period autumn. *Fruits* globular-truncate, cupular, urceolate or sub-cylindrical, pendulous, pruinose when immature, 10–15 mm long, 10–14 mm diam.; pedicels 2–4 cm long; disc descending; locules 4 or 5; valves enclosed; staminophore intact. *Fertile seeds* ovoid, flattened, brown, finely reticulate; hilum ventral.

Etymology: The epithet is derived from the Latin *decorus* "beautiful" in reference to the ornamental effect of the copiously pruinose branchlets, petioles and buds and the slate-grey colour of the canopy.

Distribution and habitat: The new taxon is known from two localities in the St. Arnaud district; one to the east of Bealiba and the second in the Redbank area (Fig.1). Its preferred habitat is gravely red loam on shallow laterite rises.

Associated species: *E. tricarpa* subsp. *decora* forms open woodland communities where it is always the dominant eucalypt. *E. tricarpa* subsp. *tricarpa*, *E. leucoxylon* F. Muell. subsp. *pruinosa* (F. Muell. Ex Miq.) Boland, *E. canaldulensis* Dehnh., *E. albens* Benth., *E. nortonii* (Blakely) L.A.S. Johnson, *E. microcarpa* Maiden, *E. macrorhyncha* F. Muell ex Benth., *E. polyanthemos* Schauer. subsp. *vestita* L.A.S. Johnson & K.D. Hill and *E. polyanthemos* subsp. *marginalis* K. Rule subsp. nov. occur with or around the margins of the populations of the new taxon. At both localities where the new subspecies occurs there is no evidence of interbreeding with the typical form or with any other taxon.

Conservation status: The occurrence of the new subspecies in the Bealiba S. F. is relatively large, covering many hectares and consisting of thousands of plants. It, however, is subject to regular firewood harvesting. Despite the site abounding with seedlings and saplings, large numbers of mature trees have been lost. The Redbank occurrence is larger in area; a part of which is protected within the Moyreisk Flora Reserve. Other plants survive along road reserves and on adjacent farms. It is highly likely that other remnant populations occur in the region. A status of 2V is recommended in accordance with Briggs and Leigh (1996), particularly as the taxon appears to be favoured for firewood harvesting.

Discussion: Johnson (1962) erected *E. sideroxylon* subsp. *tricarpa* to accommodate "3-flowered, large-fruited, non-glaucous" ironbark populations occurring in coastal and sub-coastal regions of New South Wales and Victoria and of inland central Victoria. Later Hill & Johnson (1991) raised it to a species rank. The populations of three-flowered ironbark with waxy features were brought to my attention in 1990 and comparative studies showed them to be distinctive from the typical form which is non-pruinose and has green, lanceolate to ovate juvenile leaves and green or blue-green adult leaves.

The precedent of giving pruinose, grey-leaved forms the rank of species has been set by the erection of *E. nortonii*. In the case of this new taxon, although it occurs in pure populations and is distinctive by its heavy pruinosity and relatively narrow juvenile leaves, it is here considered best recognised as a subspecies as it shows no other substantial morphological divergence.

Additional specimens examined: **VICTORIA**: 3 km east of Bealiba township, *G. Wallace*, 23.viii.1984 (MEL666614); 3.5 km east of Bealiba on the Ponderosa Road, *P. Foreman 200 & M. Findlay*, 10.vi.1993 (MEL2016610); Bealiba S. F., 4.5 km east of Bealiba by road, *K. Rule 0248 and V. Stajsic*, 10.v.2002 (MEL); 4.4 km east of Sunraysia Hwy on Moyreisk-Dunolly Road, north-east of Redbank, *K. Rule 0249*, 10.v.2002 (MEL); Moyreisk Reserve, 45 km south of the southern roundabout, St. Arnaud, *K. Rule 0251*, 10.v.2002 (MEL).

SERIES *HETEROPHLOIAE*: RED BOX

A depauperate, green-leaved form of red box, *E. polyanthemos* Schauer, is described here. It occurs in box-ironbark forests and mallee-box communities of the north-central and west-central regions of Victoria and to the west of Melbourne in the Bacchus Marsh area.

KEY TO THE SUBSPECIES OF *Eucalyptus polyanthemos*

1. Smooth bark over most of the trunk.....subsp. *polyanthemos*
1a. Box bark extending to at least the major branches.....2

2. All juvenile and adult structures non-pruinose.....subsp. ***marginalis***
2a. Seedlings, branchlets, adult leaves and buds pruinose.....3

3. Lanceolate adult leaves present in the outer canopy of mature trees.....subsp. *longior*
3a. Lanceolate adult leaves absent from the canopy of mature trees.....subsp. *vestita*

Eucalyptus polyanthemos Schauer subsp. ***marginalis*** K. Rule *subsp. nov.*

A subspecie typica habitu minore non-pruinosa, cortice persistente buxiforme, foliis adultis viridibus et a subspecie *vestita* habitu minore, foliis juvenalibus minoribus, ramulis alabastris et fructibus non-pruinosis differt.

Type: Victoria, Western edge of Tottington S. F. on the Kanya Road, *K. Rule 9824*, 5.vi.1998 (holotype: MEL).

Small, depauperate *trees* or rarely *mallees*, 3–12 m tall. *Bark* grey-brown, box-like, often flaky and loose, rarely peppermint-like, persisting to major branches. *Juvenile leaves* obcordate, sub-orbicular or orbicular, usually emarginate, disjunct, dull, blue-green, 3–5 cm long, 3–5 cm wide; petioles slender, non-pruinose, 2.4–3.6 cm long. *Intermediate leaves* sub-orbicular or broadly ovate, dull or sub-lustrous, blue-green, present in saplings and young trees and persisting in the canopies of mature trees. *Adult leaves* ovate or rarely lanceolate, eventually sub-lustrous or rarely lustrous, blue-green, light green or olive-green, sub-coriaceous (0.25-0.40 mm thick), 5–8 cm long, 2–3.3 cm wide; petioles 1.8–2.6 cm long; venation densely reticulate with conspicuous lateral veins and crowded, unbroken veinlets; intramarginal veins looped, 2–4 mm from the margin; oil glands irregular, small, island or intersectional. *Inflorescences* 7-flowered, within a compound, leafless, branched, terminal panicle; peduncles slender, 10–16 mm long. *Floral buds* ovoid, pedicellate, scarred (outer operculum shed in early bud development), non-pruinose, burnished, 5–6 mm long, 3–4 mm diam.; pedicels slender, slightly longer than the buds; operculum obtuse, c. 3 mm long, narrower than the hypanthium; stamens irregularly inflexed, outer whorls infertile; filaments white, old stamens shed with the staminal ring; anthers adnate, basifixed, globoid, dehiscing through lateral pores; ovules in 4 vertical rows; flowering period spring. *Fruits* cupular or sub-cylindrical, 5–6 mm long, 3–4 mm diam.; pedicels as long as fruits; disc descending; locules 3 or 4; valves enclosed. *Fertile seeds* brown, irregular ovoid, finely reticulate; hilum ventral.

Etymology: The epithet is derived from the Latin *marginis* "border" or "edge" in reference to the populations of the taxon which occur at the south-eastern limits of the red box complex.

Distribution and habitat: The new taxon occurs on the drier margins of the Victorian box-ironbark forests from Kamarooka in the east to Stawell in the west. It also occurs adjacent to or within mallee-box communities, for example, at Kamarooka and Wedderburn. The preferred habitat is dry, gravely, shallow soils, often over laterite rises. Southern outliers occur in the Bacchus Marsh area, for example, in Brisbane Ranges and the Pyrete Range (Fig. 1).

Associated species: Populations of *E. polyanthemos* subsp. *marginalis* occur with both subspecies of *E. tricarpa*, *E. macrorhyncha*, *E. microcarpa*, *E. nortonii*, *E. aromaphloia* and *E. leucoxylon* subsp. *pruinosa*. In mallee-box communities *E. viridis*, *E. polybractea*, *E. behriana* F. Muell. and *E. froggattii* may be present. The new subspecies and the more easterly distributed subsp. *vestita* overlap in north-central Victoria. In areas including the Castlemaine area, at Long Forest near Bacchus Marsh, to the south of Bendigo, to the south of Avoca and in the St Arnaud Range obvious hybrid populations occur. These populations exhibit a wide range of intermediate features, particularly in leaf colour and pruinosity.

Conservation status: The new taxon occurs over a wide area but nowhere is it dominant. All populations are small and many occur in protected reserves, for example, Whipstick S.P., Kamarooka S.P., Tottington S.F., Bolangum S.P., Bealiba S.F., Brisbane Ranges N.P. and Pyrete Range S.P. It is not considered at risk.

Discussion: The new taxon has several morphological forms. The population from which the type specimen has been drawn is typical of populations occurring throughout north and west-central Victoria. This form features a winter canopy dominated by soft-textured, dull, blue-green leaves. However, its summer new growth produces sub-lustrous light green, firm-textured foliage. More southerly forms, such as those in the Brisbane Ranges and the Pyrete Range, develop sub-lustrous intermediate leaves which can often be observed in the sapling stage regardless of the season. The form occurring in the Pyrete Range features an atypical peppermint-like bark. When in association with mallee-boxes, such as around Wedderburn and in the Whipstick, specimens are often only a few metres tall with a typical mallee habit.

E. polyanthemos subsp. *polyanthemos*, which occurs along the western slopes of the Great Divide in central and southern New South Wales, differs from the new subspecies by its usually larger habit (often an umbrageous tree with a stout trunk), its mostly smooth bark, its canopy, which is dominated by greyish, broadly ovate or sub-orbicular intermediate leaves, and its pruinose seedlings, branchlets and buds.

E. polyanthemos subsp. *marginalis* was previously included with subsp. *vestita* by Hill and Johnson (1990), but recent field studies and seedling trials have shown it to be a distinctive geographical and morphological form. From the new taxon subsp. *vestita* differs by its generally more easterly distribution, its generally more robust habit (trees are usually smallish, but with a stout trunk), its canopy being dominated by greyish, broadly ovate or sub-orbicular intermediate leaves, its larger juvenile leaves (to 7 cm long, 7 cm wide) and its pruinose seedlings, branchlets, canopy leaves and buds.

E. polyanthemos subsp. *longior* Brooker & Slee, which is a forest form occurring in East Gippsland and adjacent areas of New South Wales, has a canopy dominated by lanceolate adult leaves. It is also readily separable from subsp. *marginalis* by its taller habit and its pruinose features.

E. polyanthemos subsp. *marginalis* has been erroneously confused with *E. baueriana* Schauer. The typical form of *E. baueriana* features greenish, often slightly glossy adult leaves, not unlike those of the new taxon, but differs by its riparian habitat, its often deltoid, conspicuously undulate canopy leaves, its clavate buds and its obconical fruits. The form of *E. baueriana* occurring in the Melton-Bacchus Marsh area, however, features adult foliage that is dull, grey-green and not is readily confused with the new subspecies.

Additional specimens examined: **VICTORIA**: County of Talbot, *F.M. Reader*, 18.iv.1909 (MEL1616224); Korongvale, *F.W. Wakefield*, 7.vi.1919 (MEL231053); Bullengarook near Gisborne, *K.V.M. Fergusson*, Aug. 1943 (MEL1526773); Coimadai District near Bacchus Marsh, *P. Carolan*, May 1965 (MEL1614725); Waterloo Range near Maryborough, collector unknown, 26.viii.1971 (MEL231046); Melville Caves, off Kingower-Wedderburn Road, *K.L. Wilson 1044 & L.A.S. Johnson*, 15.ii.1975 (MEL1614730); Brisbane Ranges N.P., 5.5 km N. E. of Mt. Wallace P. S., *A.C. Beauglehole ACB56740 & E.G. Emery*, 2.x.1977, (MEL230927); Dalynong S. F., 9 km

WNW of Archdale, *A.C. Beauglehole ACB64701*, 8.ix.1979 (MEL230925); Muckleford Flora Reserve, *A.C. Beauglehole ACB68968 & E.E. Perkins*, 31.viii.1981 (MEL230929); 1 km SW of Chewton, 4 km ESE of Castlemaine, *T.B. Muir 6713*, 6.x.1981 (MEL); Eaglehawk Regional Park, *A.C. Beauglehole ACB69506*, 30.x.1981 (MEL230922); Brisbane Ranges N.P., near the Anakie Gorge car park, *D.B. Foreman 1554*, 10.iii.1986 (MEL2042461); c. 5 km north of Elmhurst, *I.C. Clarke 2008*, 13.x.1989 (MEL1582879); 7.3 km from Inglewood towards Kingower, *M.H.I. Brooker 11107*, 4.vi.1992 (MEL17369); Reids Road, the north-east entrance to the Brisbane Ranges N.P., *K. Rule 9815*, 8.v.1998 (MEL); c. 7 km south-east of Wedderburn on Calder Hwy., *K. Rule 9827*, 5.vi.1998 (MEL); 2.1 km along Skinner's Flat-Mt. Kerang Road from Calder Hwy., *K. Rule 9903*, 26.iv.1999 (MEL); 24.9 km north of Bendigo towards Kamarooka on the Bendigo-Tennyson Road, *K. Rule 9970*, 11.vii.1999 (MEL); 1.2 km north of Matthews Lane on West Kamarooka Road, *K. Rule 9971*, 11.vii.1999 (MEL); Western Highway, 9.3 km south-east of turnoff to Stawell City Centre, *K. Rule 9973*, 12.x.1999 (MEL); southern edge of Pyrete Range S. P., *K. Rule 0107*, 19.v.2001 (MEL); Bealiba S. F., 3.2 km east of Bealiba by road, *K. Rule 0109* & *V. Stajsic*, 2.vi.2001 (MEL).

NOTES ON VICTORIAN POPULATIONS OF *Eucalyptus calycogona* Turcz.

A recent paper by Nicolle (2000) divided *Eucalyptus calycogona* into three subspecies; susbsp. *calycogona* for western populations (Western Australia and the western part of South Australia) with a small mallee habit, smooth bark, relatively small, thin adult leaves and relatively fine buds and fruits; subsp. *trachybasis* Nicolle for eastern populations (eastern parts of South Australia and extending into New South Wales and Victoria) with a more spreading, larger habit, than typical, basal rough bark, relatively large, coarse adult leaves and relatively large buds and fruits; and subsp. *spaffordii* (Blakely) Nicolle for restricted populations on the Eyre Peninsula with a small mallee habit, smooth bark, broad, coriaceous adult leaves and relatively large, conspicuously winged buds and fruits.

Surveys within Victoria have shown that most populations are subsp. *trachybasis*. It is common throughout north-western Victoria and extends to the Wimmera region, mostly to the north of the Little Desert where it is relatively common. Outlier populations occur in North-central Victoria to the south-east of Wedderburn, near Boort and in the southern Wimmera near Natimuk and at Mt. Arapiles. Whilst the Wedderburn and Boort populations are clearly subsp. *trachybasis*, the southern Wimmera populations possess features that are somewhat intermediate between that form and susbp. *calycogona*. The adult leaves of the Natimuk population are appreciably smaller and thinner than more northerly populations (leaves 4–6 cm long), whilst its other features, particularly habit and bark, are consistent with subsp. *trachybasis*. The population occurring at Mt Arapiles also fits the general description of subsp. *trachybasis* except that it has a slender pole-like habit, sheds its basal bark in spring and bears flowers whilst still in the seedling stage. This form of neoteny within the genus is not well documented and at this stage such behaviour is here considered insufficient to warrant the erection of a new subspecies.

A remnant population occurring to the north-east of Kaniva features a slender habit, a short stocking of box bark and relatively broad, coarse adult leaves. A few individuals have buds and fruits approaching those of subsp. *spaffordii* but these are far from being representative of the population and are considered insufficiently divergent to be regarded as that subspecies.

A small population of a several dozen plants occurring in the southern Wimmera in the Nurcoung Nature Reserve, fits Nicolle's general description of susbp. *calycogona*. Its features include the following; smooth bark to the ground; a whipstick mallee habit to about 3 m tall; small, thin-textured adult leaves (4–7 cm long); and small, somewhat slender, lightly ribbed fruits. The buds, however, are subtly distinctive, being finely winged with an operculum that is relatively long, acutely conical and appreciably narrower than the hypanthium.

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Morphological and genetic variation in the rare daisy *Olearia pannosa* subsp. *cardiophylla* (Asteraceae)

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Abstract

Olearia pannosa Hook. subsp. *cardiophylla* (F.Muell.) D.A.Cooke is rare and vulnerable, occurring in small populations in only four reserves within the state of Victoria. Variation within and among populations of this taxon was assessed morphometrically and by random amplified polymorphic DNA (RAPD) analysis. Morphological analysis, including herbarium samples from South Australia, confirmed the distinction of this subspecies from *O. pannosa* subsp. *pannosa* and validated the characters Cooke (1986) used to distinguish the two subspecies.

Genetic variability within subsp. *cardiophylla* was detected within local populations, among populations and between geographic regions in Victoria. The disjunction between populations of northern (Rushworth and Wedderburn) and southern (Brisbane Ranges and Anglesea) regions confirmed by RAPD analysis was supported by morphometric analysis, although Rushworth individuals appear to be more distinct genetically than morphologically. Gene flow between geographic regions appears to be restricted. An assessment of fruit condition and seed viability determined that between 7.5% and 21.2% of all fruits contained viable seed.

Key words: *Olearia pannosa*, Asteraceae, rare taxa, genetic variation, RAPDs

Introduction

Olearia pannosa Hook. (Asteraceae) is a long-lived perennial with plants possibly able to live more than 100 years (Cropper 1993). The species is a sprawling undershrub to 1.5m high with erect or prostrate woody stems. Leaves are alternate, broad-ovate to elliptic and stems and the underside of leaves are densely tomentose, the last of these features presumably prompting the specific epithet '*pannosa*' and the common name 'Velvet Daisy-bush'. Inflorescences are 35 to 75mm in diameter, terminal and solitary. Ray florets have white ligules and the corolla of the disc florets is yellow.

First described by Hooker (1851), *Olearia pannosa* has undergone several taxonomic changes. Following an initial amendment to the description by Lindley and Paxton (1852), the species was subsequently divided into two and placed in separate genera, *Olearia pannosa* and *Eurybia cardiophylla* (Mueller 1853). Simultaneously, Sonder (1853) changed the genus completely, and recognised two species, *Steetzia pannosa* and *S. imelleria*. It is unknown whether the two authors collaborated prior to publishing their descriptions in the same journal volume. Despite Sonder's nomenclature, Mueller described *Olearia pannosa* as *Eurybia pannosa* in 1865 (Mueller 1865a), placing the two species back into the same genus. In the same year, Mueller described *Eurybia pannosa* as *Aster pannosus* (Mueller 1865b) and once again recognized the two species as distinct at the generic level. The taxonomy was then untouched until 1986, when D.A. Cooke described the species as *Olearia pannosa*, and recognized two subspecies: *Olearia pannosa* subsp. *pannosa* and *Olearia pannosa* subsp. *cardiophylla* (F.Muell.) D.A.Cooke, based on leaf shape and tomentum of lower leaf surfaces and peduncles.

Olearia pannosa is endemic to South Australia and Victoria. In South Australia, populations occur on the Eyre Peninsula, Yorke Peninsula, around Adelaide and

Kangaroo Island, and the two subspecies *pannosa* and *cardiophylla* (F.Muell.) D.A.Cooke are also recognised. Victorian specimens are referred to *Olearia pannosa* subsp. *cardiophylla*, although Walsh and Lander (1999) suggested that this subspecies required recognition at the rank of species. Distributions of the two subspecies are presented in Figure 1.

In Victoria, *Olearia pannosa* subsp. *cardiophylla* is rare and listed as threatened under the Victorian Flora and Fauna Guarantee Act 1988 (Anon 2000), and an action statement has been prepared (Hills *et al.* 2003). However, the conservation status is not recognized at national level, and the species is not listed under the Commonwealth 'Environment Protection and Biodiversity Conservation Act' 1999 (Hills *et al.* 2003).

Victorian populations of *O. pannosa* subsp. *cardiophylla* are restricted to shallow, rocky soils in woodland and open forest areas usually dominated by *Eucalyptus macrorhyncha* F.Muell. ex Benth., *Acacia pycnantha* Benth. and *Xanthorrhoea australis* R. Br., where mean annual rainfall ranges from 600 to 650 mm. It occurs across a range of aspects, except

Figure 1. (A.) Distribution of *Olearia pannosa* in Australia. Grey area: Distribution of subsp. *cardiophylla* and subsp *pannosa* in South Australia. Black area: Distribution of subsp. *cardiophylla* in Victoria. (B.) Distribution of *Olearia pannosa* subsp. *cardiophylla* populations in Victoria.

on exposed north-western slopes (Galbraith 1967; Wisniewski *et al.* 1987; Cropper 1993).

A number of small populations occurs in the Brisbane Ranges, and also near Wedderburn, Rushworth and Anglesea (Fig. 1) with some morphological variation noted across this range. Few known large plants remain, and populations occur in unprotected areas where they are subject to threats such as browsing by mammals, roadworks, erosion and rubbish dumping (Wisniewski *et al.* 1987; Bartley 1990).

Flowering occurs between August and October, and seed is ripe from early December until May (Wisniewski *et al.* 1987; Cropper 1993). Seed set appears to be low, and Bartley (1990) reports that unexpanded fruits may be damaged by mould or a fungus-eating beetle (*Corticaria* sp.). Seedling recruitment is negligible (Wisniewski *et al.* 1987) and, with the added pressure of habitat loss, poses a threat to long-term survival of the subspecies. Although Cooke (1986) describes the species as 'root suckering', Wisniewski *et al.* (1987) confirmed by sectioning that shoots arise from decumbent stems. Cloning by shoot suckering has been found in at least one population in the Brisbane Ranges National Park, Victoria (N. Walsh pers. comm.). The small shoot suckers, although resembling seedlings, can be distinguished from the latter by the absence of small teeth on the leaf margins (Cropper 1993).

The aims of this study were to clarify patterns of morphological and genetic variation and provide data on seed set to improve conservation strategies. *Olearia pannosa* was compared morphologically across its range to evaluate the current taxonomic status of the two subspecies. The genetic variation of all known populations of the rarer subspecies *cardiophylla* in Victoria was assessed using the molecular random amplified polymorphic DNA (RAPD) technique. Seed set, viability and predations were also assessed.

Methods

Morphology

Within Victoria, *Olearia pannosa* subsp. *cardiophylla* populations were sampled from four locations, including four populations in and around the Brisbane Ranges (Demott's Rd, Anakie Gorge, Maude–Sheoaks Rd and Steiglitz), two at Anglesea (Point Addis and Ironbark Basin) and single populations at Wedderburn and Rushworth. At least five plants were sampled from each population except where small population size and rarity restricted sample size to three.

In total, collections for morphological analysis included 59 samples from nine sites within the four locations. One stem was taken from each plant for morphological measurements, preferably with a terminal, solitary inflorescence. Three to five specimens from each site were lodged as voucher herbarium specimens at The University of Melbourne Herbarium (MELU) and the National Herbarium of Victoria (MEL). For this study, herbarium specimens of both subspecies of *O. pannosa* at MEL and MELU supplemented these collections and included specimens from South Australia. Eighty-one specimens were initially compared for 15 morphological leaf characters, including binary, multi-state and continuous measurements (Table 1). However, six characters were uninformative and removed from the analyses (leaf width, leaf width 1 cm from tip, leaf length: leaf base at widest point, presence of hairs on upper lamina, colour of lower lamina, leaf apex angle). In an attempt to eliminate any ontogenetic variation, only mature leaves were measured. Although five leaves were considered a reasonable minimum sample size, only three mature leaves were available for many specimens. Hence, for consistency, the three largest leaves on each specimen were measured and mean values recorded.

Ratios were derived from some of the continuous character measurements in order to express leaf shape. The use of ratios allowed the inclusion of more informative characters in the analysis where the constituents were not largely variable. The use of ratios has been criticised by some authors (Atchley and Bryant 1976; Phillips 1983; Frampton and Ward

Table 1. Characters scored for morphometric analysis

Continuous characters
1. Leaf length (mm)
2. Leaf base to widest point (mm)
3. Petiole length (mm)
Ratios
4. Leaf length: leaf width at widest point (mm)
5. Leaf width at widest point: leaf width 1 cm from tip
6. Leaf apex angle
Binary and multistate characters
7. Leaf lamina elliptic to ovate/ broad-ovate (0/1)
8. Fine hairs on lower surface of leaf appressed strongly/ partially (0/1)
9. Leaf base obtuse/ acute/ truncate- shallowly cordate (0/1/2)

1990) because ratios may have undesirable statistical properties and often result in a high correlation between the ratio and its constituent size variables (Phillips 1983). Problems with ratios have been overcome in this study by the removal of the least informative variable, which is in effect redundant, adding nothing new to the analysis (Wright and Ladiges 1997).

Morphological data were analysed phenetically using the PATN pattern analysis package (Belbin 1995). A matrix of dissimilarity was produced using the Gower metric, and a hierarchical clustering was produced using the Unweighted Pair Group Method of Averaging (UPGMA) fusion strategy. The cophenetic correlation coefficient was used to measure how well the dendrogram represented the information in the dissimilarity matrix. An ordination of the data was produced in two and three dimensions using the non-metric multidimensional scaling (NMDS) technique. A two dimensional ordination was produced using the PATN package, while a three dimensional ordination was performed using the Ntsys numerical taxonomy and multivariate analysis system (Rohlf 1998) in order to compare these data with the genetic analysis.

A comparison of appressed leaf hairs in *O. pannosa* subsp. *pannosa* and subsp. *cardiophylla* was made using 50 mm^2 sections of leaf material. Sections were dehydrated in an ethanol series (70, 80, 90 and 100%), mounted on carbon-coated stubs and coated with silver. Specimens were then sputter coated with gold, viewed under a Phillips FEG Scanning Electron Microscope (2.00 kV) and photographed at x30 and x90 magnifications.

Genetic analysis

RAPD analysis is one of the most extensively used DNA fingerprinting techniques, based on the Polymerase Chain Reaction, for measurements of diversity (Karp *et al.* 1996; Hoelzel 1998). RAPD technique has proved a useful method for detecting polymorphisms where *a priori* knowledge of the genome is not available and can enable assessment of genetic relationships and diversity estimations among individuals (Maxted *et al.* 1997; Ayres and Ryan 1999). The dominant RAPD markers reveal polymorphism as band presence/absence, with each band assumed to represent a single locus (Krauss and Peakall 1998).

For DNA isolation and RAPD analysis, four or five young leaves were collected from 10–20 plants within each population (with the exception of Wedderburn, where only two samples were taken from the small patch at this site). Care was taken to avoid sampling obvious clones, or suckers, and where possible samples were taken at least 10 metres apart. The 47 samples were wrapped in moist paper towel and kept on ice for

transportation, before storage at –86°C within 24 hours of collection.

DNA was isolated from approximately 50 mg of frozen leaf material from a number of samples from each population (Wedderburn, 2; Rushworth, 10; Anglesea, 18; Brisbane Ranges, 17) using the Nucleospin Plant DNA extraction kit. Twenty-nine RAPD primers were screened, and five were chosen for the analysis. Seventeen did not amplify the DNA at all, while remaining primers only amplified a small number of fragments. PCR reaction mixtures (20 µl final volume) contained 10 µl HotStartaq mastermix reaction buffer (Promega) (containing *Taq* polymerase buffer, *Taq* polymerase, dNTPs, $MgCl_2$ and BSA (bovine serum albumin), 8.2 µl H_2O and 1.0 µl of template DNA (approx. 20 ng). Amplification was carried out in an Eppendorf Mastercycler ® gradient thermocycler programmed as follows: initial 15 m at 95°C, then 35 cycles of 30 s at 95°C denaturation, 30 s 38°C annealing, 30 s 72°C extension and an additional 4 m 30 s period for extension followed the last cycle. Reproducibility of amplification product profiles between reactions was tested by performing duplicate PCR runs for three samples with each primer, as in Cambecedes *et al.* (1999), and a dilution series of four Rushworth samples was used to ensure that the RAPD patterns were consistent over a range of DNA concentrations. A negative control with DNA omitted was included for every PCR run to check for contamination.

The amplification products were separated by electrophoresis in 1.5% agarose using x 1 TBE buffer at 80 V for 1 to 1.5 hours, depending on the primer. Ethidium bromide was added to the agarose to stain the DNA. Resultant gels were photographed on an ultraviolet transilluminator using Polaroid film, or scanned using Kodak DCS 120 imaging software and saved as a digital image.

Amplified fragments were scored as present or absent, with ambiguous and monomorphic bands removed from the data set. Typically, 5–20 bands were produced per primer. A similarity matrix was generated using the Jaccard coefficient, which excludes negative matches, because the mutual absence of bands among individuals may not be the result of a common cause. An agglomerative hierarchical classification was generated using the UPGMA method of clustering. Three-dimensional NMDS ordinations were also generated from the similarity matrix. All analyses were performed using the Ntsys numerical taxonomy and multivariate analysis system (Rohlf 1998).

Seed production and viability

In January 2002, 20 capitula were collected, one per plant, at random from each of three locations (Rushworth, Anglesea and Brisbane Ranges) for the assessment of fruit condition and seed viability. The mean number of fruits per capitulum was calculated for each population under each of the three categories specified by Wisniewski *et al.* (1987) and Bartley (1990): (i) fruits unexpanded or empty, (ii) partially or completely damaged by predation, and (iii) filled fruits with developed and apparently viable seed.

The viability of approximately 100 seeds, pooled from all capitula collected, was tested using tetrazolium. Seeds were cut in half longitudinally and seed coats removed. Half of each seed was soaked in a filtered TTC (triphenyl tetrazolium chloride) solution (1g in 100 ml phosphate buffer, pH 6.5–7.0) for 40 minutes in darkness at 30°C and rinsed in sterile distilled water. Embryos were considered viable if completely coloured pink or red and not viable if embryos were partially coloured or white, yellow or brown (Rasmussen 1995).

A test of self-compatibility was done during this study on the Brisbane Ranges populations. Cotton interfacing bags were tied over capitula in bud for six plants. After a few weeks the bags were removed to determine whether any flowers had set seed.

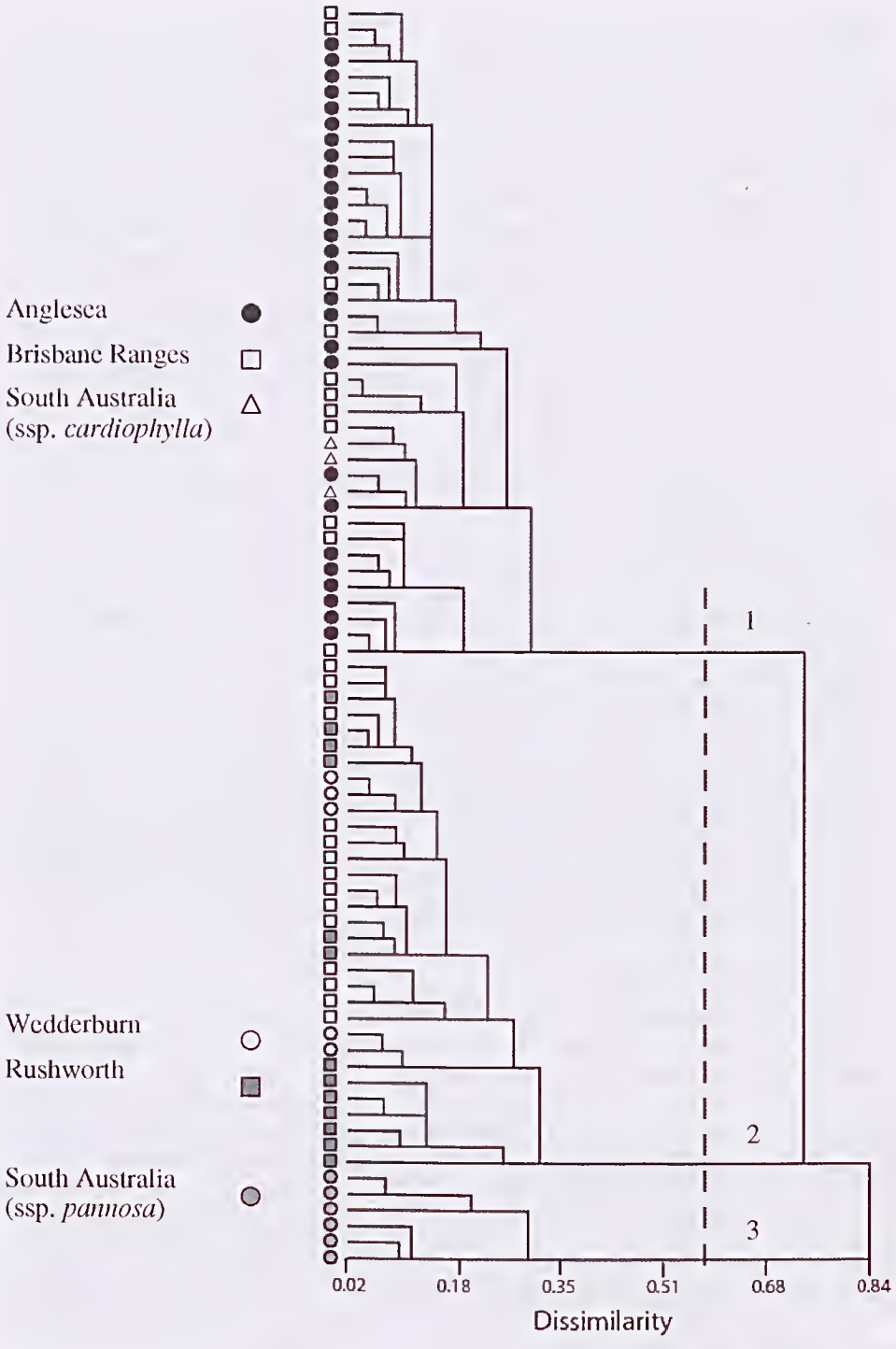

Figure 2. Agglomerative hierarchical classification of 81 specimens based on morphology using UPGMA clustering technique. Co-phenetic correlation coefficient = 0.81. Groups referred to in the results and discussion are numbered above the branches on the dendrogram.

Results

Morphology

The hierarchical classification of the 81 specimens of subsp. *cardiophylla* and subsp. *pannosa* (Fig. 2) identified three main groups with a high correlation coefficient (0.81). Group one contains all individuals of subsp. *cardiophylla* from Anglesea (Point Addis and Ironbark Basin), whilst group two contains all individuals from Wedderburn and Rushworth. Individuals from populations within the Brisbane Ranges region were distributed in groups one and two, with Demotts Rd and Steiglitz populations mostly clustering within group one and Maude–Sheoaks Rd and Anakie Gorge populations clustering entirely within group two. Herbarium specimens of subsp. *cardiophylla* from South Australia cluster in group one with the field-collected specimens from Anglesea and the Brisbane Ranges in Victoria. Group three consists solely of herbarium specimens of subsp. *pannosa* from South Australia.

Three binary characters, appression of hairs on the underside of the leaf (character 8), leaf lamina shape (character 7) and leaf base shape (character 9) were highly informative in separating the groups (Kruskal-Wallis values 66.16, 40.31 and 75.70 respectively). Leaf hairs of both subspecies are shown in Figure 3, illustrating that the hairs of group 3 are markedly more appressed than those of groups 1 and 2. Of the continuous characters, the most informative were the ratio of leaf length to width (character 4, Kruskal-Wallis value 42.65) and leaf apex angle (character 6, 20.14). The least informative character in separating the groups was distance between leaf base and widest point (character 2, 8.81). An example of the variation observed in leaf lamina shape is shown in Figure 4.

The NMDS ordination (Fig. 5) demonstrated two discrete groups corresponding to the two subspecies; subsp. *pannosa* (group 3) and subsp. *cardiophylla* (groups 1 and 2). Individuals from the Anglesea region, and those from Wedderburn and Rushworth, tended to cluster separately, based on leaf lamina shape and angle of the leaf base (Table 2). However, discrete groups were not evident in the ordination. Populations within the Brisbane Ranges region were the most variable. Half of those individuals grouped closely

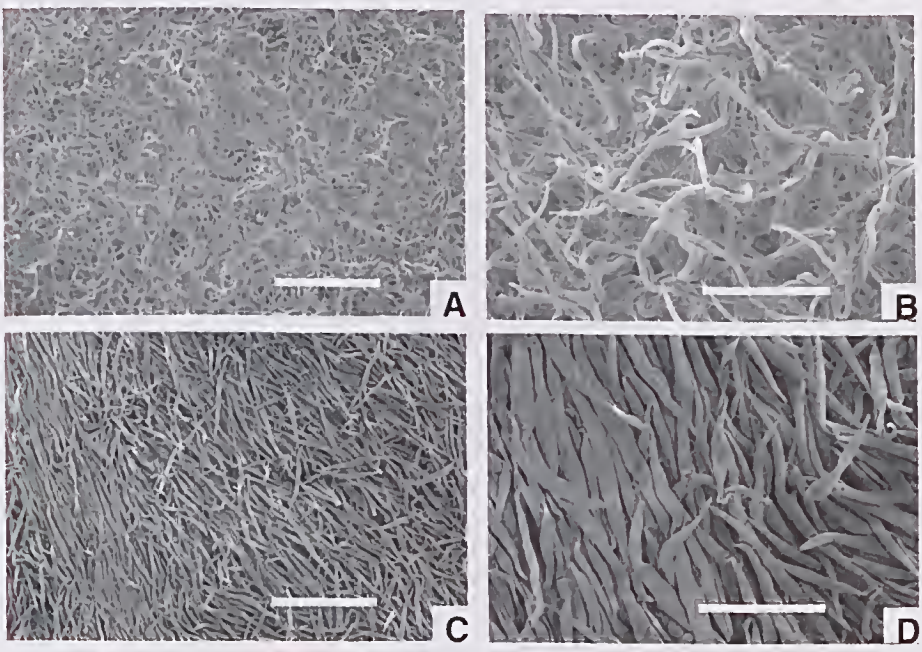

Figure 3. Comparison of leaf hairs on the underside of leaves in *O. pannosa* subsp. *cardiophylla* (A and B) and *O. pannosa* subsp. *pannosa* (C and D). Scale bar = 200 μm (A and C), 500 μm (B and D).

Figure 4. Variation in leaf shape of *O. pannosa* subsp. *cardiophylla* in Victoria. Three leaves are shown from each geographic location: (A) Anglesea, (B) Rushworth and (C) Wedderburn. Brisbane Ranges populations exhibit a range of forms, corresponding to A, B or C. Scale bar = 2.5 cm.

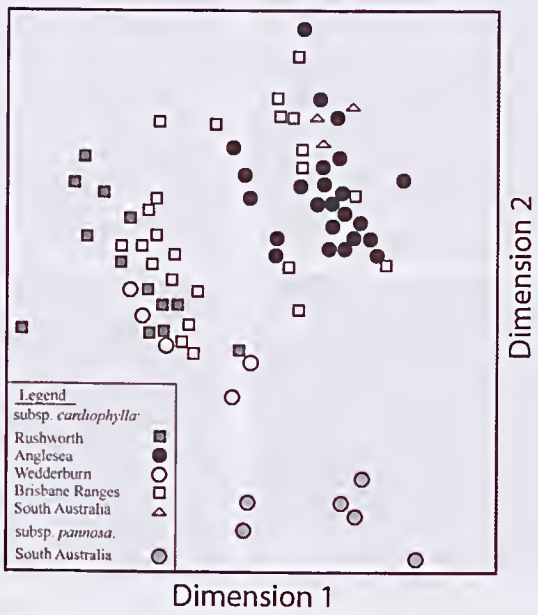

Figure 5. NMDS ordination in two dimensions of individual plants based on morphometric data. Stress = 0.14.

Table 2. Kruskal-Wallis statistics and mean values (and range) for nine morphological characters, based on groups defined in Figure 2.

Character	Kruskal-Wallis Statistic	*Group* 1	2	3
Leaf lamina elliptic to ovate/broad ovate%	40.31	80.5	0	66.7
Fine hairs on lower surface of leaf appressed strongly/ partially %	66.16	100	96.9	0
Leaf base obtuse/ acute/ truncate-shallowly cordate %	75.70	100	9.4	0
Leaf length (mm)	10.63	68.2 (45–86)	66.6 (47–92)	49.8 (40–64)
Leaf base to widest point (mm)	9.01	19.3 (14–26)	22.0 (16–31)	20.6 (15–28)
Petiole length (mm)	13.23	7.3 (4–12)	6.9 (3–8)	5.5 (4–6)
Leaf length: leaf width at widest point	42.99	0.7 (0.5–1.7)	0.5 (0.4–0.8)	0.4 (0.3–0.5)
Leaf width at widest point: leaf width 1 cm from tip	12.51	2.0 (1.6–2.6)	1.9 (1.4–2.7)	1.6 (1.3–1.8)
Leaf apex angle	21.27	64 (50–77)	58 (42–80)	39 (30–50)

with those from Anglesea, and the other half with the Wedderburn and Rushworth individuals. One Rushworth specimen appears as an outlier in the ordination due to the occurrence of appressed hairs on the underside of the leaves, as was seen in specimens of subsp. *pannosa*.

Genetic Analysis

Genetic analysis was conducted on specimens sampled from Victoria only.

Five primers (OPA-2, OPA-3, OPA-13, OPB-10 and OPF-4) generated a total of 42 RAPD bands, from which 29 polymorphic fragments were scored. No band was exclusive to an individual population apart from a single band found in individuals from Rushworth. Ironbark Basin and Wedderburn individuals shared a single band with three Rushworth individuals but with no other individuals from the Anglesea or Brisbane Ranges populations.

Cluster analysis of the 47 specimens shows two main groups (Fig. 6). Group one includes all individuals except those from Rushworth, which form group two. Two subgroups are formed within group one. Sub-group A includes half of the Anglesea individuals and a single Brisbane Ranges individual, while the other half of the Anglesea individuals group with remaining Brisbane Ranges individuals and the two samples from Wedderburn in Sub-group B.

The three dimensional NMDS ordination (Fig. 7) identified similar clustering to the dendrogram. Rushworth individuals cluster together, as do individuals from the two Anglesea populations. Populations within the Brisbane Ranges region also tended to cluster together. Although the dendrogram showed the two Wedderburn samples to be identical, the ordination indicates that they have a small amount of genetic variation, with two band differences and therefore, two individuals are present.

The results indicate that there is genetic variation both within and among local populations as well as between geographic regions. A pattern of divergence between northern (Wedderburn and Rushworth) and southern (Anglesea and Brisbane Ranges) populations is evident. The four Brisbane Ranges populations, the closest geographically to one another, were the most similar. A minimum spanning tree, depicted as a dendrogram, effectively displays these results (Fig. 8).

Figure 6. UPGMA classification of individual plants based on RAPD data. Co-phenetic correlation coefficient = 0.83. Groups discussed in the text are indicated on the dendrogram.

Fruit condition and seed viability

A total of 1131 fruits from Rushworth, 1097 from the Brisbane Ranges region and 1198 from the Anglesea region was extracted from 20 fruiting capitula from each location. Fruits were categorised as: unexpanded or empty; partly or completely damaged by predation; or filled fruits with developed and apparently viable seed (Table 3). Point Addis had the highest percentage of filled fruit, at 29.2%. Anakie Gorge and Rushworth populations were almost as high, with 27.0% and 17.2% of filled fruit respectively, while remaining populations had less than 6% of filled fruit. Capitula collected from Demotts Rd contained no filled fruit. Anakie Gorge had the highest level of predated fruit, with 29.5% damaged. Point Addis was the only other population with a significant level of predation (23.7%). The majority of fruits in all populations were unexpanded or empty; 99.7% of fruits collected from Steiglitz fell into this category.

Staining with TTC revealed that on average 91% of filled seeds were viable: 93.4% of Rushworth seeds, 93.1% of Brisbane Ranges seeds and 87.2% of Anglesea seeds. Seed was set in every bagged inflorescence and hence it was concluded that subsp. *cardiophylla* is either self-fertile or that apomixis can occur.

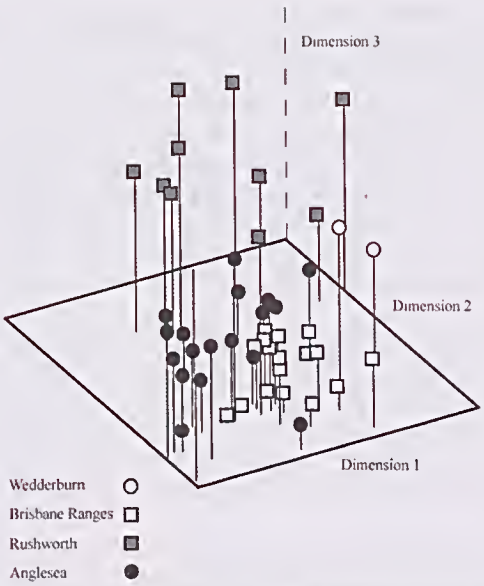

Figure 7. NMDS ordination in three dimensions of individual plants based on RAPD data. Stress = 0.29.

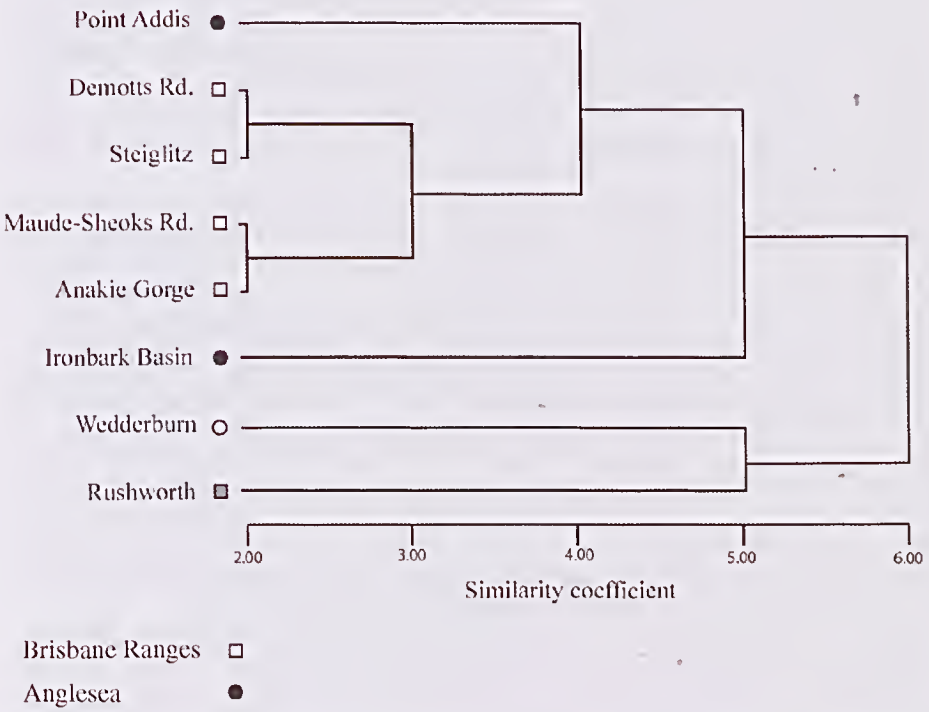

Figure 8. Minimum spanning tree (presented as a dendrogram) showing phenetic relationships of populations based on RAPD data.

Table 3. Characteristics of fruit of *Olearia pannosa* subsp. *cardiophylla*, collected from 20 mature capitula from each geographic location except Wedderburn. Results are shown for populations sampled within each region.

Population	Total no. fruits counted	%Fruits unexpanded and/or empty	% Fruits Partly eaten by insects	% Fruits filled
Point Addis (Anglesea)	945	47.1	23.7	29.2
Ironbark Basin (Anglesea)	253	94.1	0	5.9
Maude-Sheoaks Rd (Brisbane Ranges)	297	96.0	0	4.0
Anakie Gorge (Brisbane Ranges)	278	43.5	29.5	27.0
DeMotts Rd (Brisbane Ranges)	231	86.1	13.9	0
Steiglitz (Brisbane Ranges)	291	99.7	0	0.3
Rushworth	1131	79.1	3.6	17.2

Discussion

The distinction between the two subspecies, *Olearia pannosa* subsp. *pannosa* and subsp. *cardiophylla*, was corroborated by the morphometric analysis. Three binary characters (appression of hairs on the underside of the leaf, leaf lamina shape and leaf base shape) and one continuous measurement (ratio of leaf width to length) were the most informative in distinguishing between these two subspecies. This study confirmed that the characters Cooke (1986) used to describe and separate the two subspecies (leaf lamina shape, length: width ratio, leaf base shape and appression of hairs of lower leaf surfaces and peduncles) are valid.

Within subsp. *cardiophylla* collected in Victoria, northern (Wedderburn and Rushworth) populations clustered separately from southern (Anglesea) populations, with individuals from the Brisbane Ranges region occurring in both groups. Although multidimensional scaling and cluster analyses were informative in identifying patterns of variation within subsp. *cardiophylla*, there was insufficient distinction between forms to recognise any further taxa. The bases of the leaves were generally truncate to shallowly cordate in Anglesea individuals, whereas in the northern Rushworth and Wedderburn individuals, the bases were cuneate, obtuse or rounded. Leaf lamina shape was also informative in the separation of these two groups. Individuals in Group one (from southern populations) tended to have broad ovate leaves while the lamina shape of those in Group two (northern populations) was more elliptic. However, all measured characters overlapped and were not unique to either group. Lamina shape was similar between group one and group three (subsp. *pannosa*) individuals, however leaf length, length: width ratio and apex angle were substantially greater in group one individuals.

At the outset of this study it was hypothesised that there would be little genetic variation among individuals within populations of subsp. *cardiophylla* due to vegetative regeneration by shoot suckering from decumbent stems, limited seed dispersal (Bartley 1990) and the small, isolated nature of the populations. The RAPD analysis indicated, however, that within subsp. *cardiophylla* genetic variation among and within populations was evident in Victoria. No single population was found to be a clone, indicating that

sexual reproduction has and probably still does contribute to recruitment in populations.

The RAPD data were congruent with the morphological analysis in showing that the northern Rushworth individuals were genetically distinct from individuals in southern populations, and also those from Wedderburn. Brisbane Ranges populations were more variable in both datasets than other populations. Among southern populations, Point Addis (Anglesea) and Brisbane Ranges individuals exhibited some genetic differences. Individuals from Ironbark Basin (Anglesea) clustered with Brisbane Ranges individuals, even though the former population is geographically closer to Point Addis. Variation in local populations within the Brisbane Ranges region was evident from the cluster analysis, although individuals from Steiglitz showed a high degree of similarity, clustering closely together.

In the genetic analysis, Rushworth clustered separately from remaining populations, whereas in the morphological analysis this population grouped with Wedderburn and Brisbane Ranges individuals. This indicates that while the two populations overlap morphologically they are genetically distinct. Morphological analysis included only leaf characters, hence there may be other informative characters that distinguish these populations, or the morphological variation observed is phenotypic and not reflected in the genotype.

Two subgroups formed between Wedderburn, Rushworth and Anglesea individuals in the genetic analysis, where RAPD characters allowed for greater resolution of the variation. The few specimens available from the Wedderburn population were less than the ideal number of individuals sampled per population. The results were, nevertheless, included to indicate their genetic variability. The two samples from the small Wedderburn population appeared to be morphologically identical, but the two band differences noted from the RAPD profiles indicated that the small multi-stemmed bush, originally assumed to be one plant, is more than one individual. The placement of Wedderburn samples with southern populations could be an anomaly because of the small sample number and unknown history of the population.

There are two possible explanations for the genetic variation among geographic regions: historic isolation of geographic regions, and/or a current restricted level of gene flow due to habitat loss (Parker and Hamrick 1992). The greatest genetic variation was between regions separated by the largest geographic distances (northern and southern regions). Variation within a region such as the Brisbane Ranges region probably reflects the plant's fragmented distribution, with populations being small and somewhat isolated from one another. Survival of small populations in subsp. *cardiophylla* may in part be due to self-compatibility.

Small population size, which is characteristic of rare species, is often associated with increased inbreeding and genetic drift, processes that lead to loss of genetic variation, and, potentially, to a decrease in a species ability to survive environmental changes (Lande 1988; Tansley and Brown 2000). How subsp. *cardiophylla* maintains its level of genetic variation is not yet clear, but an appreciation of possible mechanisms involved is important for efficient and effective conservation management of populations. In the genetic analysis, one Brisbane Ranges individual grouped with half of the Anglesea individuals (sub-group A), and the remaining Brisbane Ranges and Anglesea individuals grouped together (sub-group B), suggesting that there has been historical gene flow. However, there are no herbarium records for populations between Brisbane Ranges and Anglesea, hence it is unknown how long these populations have been isolated. The cluster of Rushworth individuals (group two) is possibly a result of inbreeding because of the small population size and geographic isolation.

A comparison of previous records (>ten years old) of area covered by populations of subsp. *cardiophylla* indicates some decline, but also persistence in areas; some small populations have survived in areas for over 50 years (M. Bartley pers. comm.). There are several features of small, rare populations that might play a role in preventing genetic

deterioration. The ability of *Olearia pannosa* subsp. *cardiophylla* plants to sucker may provide a mechanism to survive fire and disturbance, and infrequent but significant seedling establishment could act to maintain genetic variation. Bartley (1990) notes that subsp. *cardiophylla* has slow initial shoot growth, invests early in underground storage structures and contains axillary vegetative buds and dormant buds in older stems, which could sprout after plant damage by fire, browsing or other physical injury. The species is also slow-growing and long-lived, possibly more than 100 years (Cropper 1993). One Brisbane Ranges individual was noted by H.A.Boardman to be at least 38 years old (Wisniewski *et al.* 1987). Slow growth was observed during this study in seedlings planted at Wedderburn by the Department of Sustainability and Environment.

Although insect predation has previously been noted to have an impact on the number of viable seeds in subsp. *cardiophylla* (Bartley 1990), it was found in this study that predation had a minimal impact in most populations, with levels of unexpanded or empty fruits more significant. The low level of filled fruits and rarely observed seedlings is an indication of the species' limited regeneration by seed, so vegetative reproduction is an important mechanism for retaining genotypic variation. Previous studies of fruit condition in populations from Brisbane Ranges and Anglesea (Wisniewski *et al.* 1987) revealed that only 3% of fruits contained developed seed (filled fruits), and up to 68% were damaged by predation. In this study, 29.2% of fruits in the Point Addis population contained developed seed, while the highest level of predation was comparably lower, at 29.5% at Anakie Gorge. This is an indication that predation is currently having a relatively small effect on the development of seed.

The majority of filled fruits from populations at Rushworth, Brisbane Ranges and Anglesea were determined to contain viable seed (>87%), so even though the number of filled fruits was relatively low, viable seed had been set and regeneration from seed is potentially possible. Previous germination trials found that up to 90% of filled fruits produce seed that germinates (Bartley 1990), which corresponds to the level of viable seed (91%) found in this study. Taking into account the level of viability and the percentage of filled fruits (Table 3) 5–26% of fruits per population contain potentially germinable seed.

It was concluded from this study that plants are self-compatible, hence inbreeding may be a problem. James (2000) showed that in three genera, *Laxmannia, Drosera* and *Stylidium*, species that exhibit high levels of genetic diversity have limited evolutionary potential because of impediments to recombination at meiosis, whereas species with little genetic diversity within populations and few or no lethal polymorphisms exhibit few restrictions to recombination. He considered that if populations with historically high levels of genetic diversity are forced to inbreed, due to reduced population size and increased geographic isolation, then polymorphic recessive lethals could cause low percentages of filled fruits (James 2000). Conversely, recessive lethals may provide genetic barriers to inbreeding, and hence enable the small populations to maintain levels of genetic diversity. Further study of female and male function including pollen viability is required to identify limits to sexual reproduction. A comparison of seed set following controlled selfing and cross pollination would be useful in determining whether lethal polymorphisms are present in populations of *Olearia pannosa* subsp. *cardiophylla*.

An important management consideration is that small populations are vulnerable to events that might have a relatively small impact on larger populations. Such an event occurred when a colony of 30–40 mature plants at Meredith, near the Brisbane Ranges, was severely damaged by roadworks in about 1973. In 2001, one of the study populations at Point Addis was damaged by trail bike users.

In order to improve long-term persistence, establishment of new populations in surrounding areas and augmentation of small populations is important, particularly for Wedderburn, which currently consists of only one small clump. The Department of Sustainability and Environment has replanted 29 seedlings and cuttings (originating from

the small clump) in a nearby road reserve, which will increase the effective population size. Long term monitoring will be required to see if any seedling recruitment occurs.

Protection of the habitat is the first priority for *in situ* conservation. Considering its genetic uniqueness, the conservation of the Rushworth population, which currently resides on a recently sold block of land, is essential. Either seedlings or cuttings could be used for population reinforcement or reintroduction provided that consideration is given to the maintenance of genetic diversity. The small populations at Rushworth and Wedderburn provide a dilemma for conservation because there is a risk that translocation procedures that combine divergent genomes from differentiated populations (ie. northern and southern populations) may result in reduced fitness (James 2000). However, their small population size currently makes them highly vulnerable to genetic erosion and extinction resulting from habitat loss.

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Muelleria 20: 49–52 (2004)

A new species of *Xerochrysum* (Gnaphalieae: Asteraceae) from western Tasmania, Australia

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Abstract

Xerochrysum collierianum A.M.Buchanan (Asteraceae) a new species from siliceous mountains in western Tasmania is described. Ecological notes and a distribution map are provided.

Introduction

Active collecting in the mountains of western Tasmania in recent decades has contributed to a better understanding of the taxonomy and distribution of this long-recognised but, until now, undescribed 'everlasting'. Under the nomenclature used in The Student's Flora of Tasmania, Part 2, (Curtis 1963) this plant would have belonged in *Helichrysum*. However, Anderberg and Haegi (in Anderberg, 1991) erected the new genus *Bracteantha* (pp. 102-5) for those everlastings with relatively large, conspicuous capitula having several series of relatively rigid, entire bracts, smooth glabrous achenes and barbellate pappus bristles. Unfortunately, these authors (*loc. cit.*) were unaware that Tzvelev (1990) had already erected the genus *Xerochrysum* for the same taxon, thus rendering *Bracteantha* a superfluous name (Bayer, 2001). The genus *Xerochrysum* comprises 8 species and is endemic in Australia.

Taxonomy

Xerochrysum collierianum A.M.Buchanan *sp. nov.*

Xerochryso subundulato (Schultz-Bip.) R.J.Bayer affine, sed bracteis exterioribus late, lanceolatis non triangulatis, utrinque albis non brunneis et aureis que differt.

Type: Tasmania, Central Highlands region, St Valentines Peak 1100 m, 41°22'S 145°45'E, 13.i.1986, *P. Collier 1206*, (holotype HO 116970 !).

Perennial herb to 20 cm tall with a short, more or less erect, woody, branching rootstock or vertical rhizome, 3–5 mm in diameter and densely invested with old leaf-bases through which the crowded roots arise. *Stems* arising from the branched rootstock, one to several, usually unbranched above ground level, slender, erect, leafy, with sparse, short, glandular hairs. *Leaves* loosely crowded at the base and more distant on the upper stem, alternate, oblanceolate to narrow obovate, acute, flat, sessile, attenuate to stem clasping, more or less concolorous, 20–50 mm long, 4–10 mm wide (shade leaves to 18 mm wide, e.g. Collier 5178); margins entire with a fringe of arachnoid hairs, sometimes long and tangled; upper surface with scattered to dense short glandular hairs, lower surface with similar indumentum but sparser, or glabrous. *Capitula* terminal, solitary, or occasionally with one or two subsidiary capitula developing after the terminal one nears maturity (e.g. Buchanan 15908, Rodway 395), 20–40 mm in diameter, subtended by 2-5 leaf-like bracts. Involucral bracts white, pink on the outer face when young, the outermost broadly lanceolate-acuminate, 6–10 mm long, 2.5–6 mm wide; margins usually denticulate to finely laciniate, the mid to inner ones lanceolate-acuminate 15–25 mm long, 5 mm wide, more or less entire, often notched in the apical region, not strongly reflexed at maturity;

innermost bracts shorter, often laciniate, with a dark or greenish undivided stereome sometimes extending to about midway or more along the bract; disk flat, pitted at floret attachments, otherwise more or less smooth. *Florets* 200–300, yellow, 4–6 mm long, filiform female florets in the outer whorl only and sometimes discontinuous; pappus about as long as the floret, white, finely barbellate, persistent. *Achenes* cylindrical to fusiform, glabrous, pale brown, 2–3 mm long. (Fig. 1)

Etymology: The epithet *collierianum* commemorates the extensive, enthusiastic and carefully detailed field work of Phil Collier and his wife, the late Sue Collier, in all parts of Tasmania during the period 1984 to 1992.

Figure 1. Habit of *Xerochrysum collierianum*. Scale bar = 1cm.

Figure 2. Distribution of *Xerochrysum collierianum* as known from herbarium specimens.

Distribution & Ecology: *Xerochrysum collierianum* is endemic to western and north-western Tasmania from St Valentines Peak in the north to the Ragged Range in the south (Fig. 2). It typically occurs on the open, rocky summits and ridge-tops of the Ordovician conglomerate and some quartzite mountains. These are old, very low-nutrient, siliceous rocks that support a suite of plants adapted to extremely oligotrophic sites. This plant usually grows in cracks and crevices in the rocks, in full sun, where few other flowering plants can survive. Occasional plants, growing in the shade, are taller than average and have leaves that are broader (up to 18 mm) and more rounded at the apex, e.g. Collier 5178.

Notes: *Xerochrysum collierianum* closely resembles *X. subundulatum* in habit but differs in its outermost involucral bracts being broadly lanceolate, not triangular as in *X. subundulatum*, and white on both sides, not pale brown and golden as in *X. subundulatum*. The taller shade-grown plants also resemble *X. palustre* in habit but differ by the absence of a long rhizome.

Xerochrysum collierianum is illustrated in Kirkpatrick (1997), figure 30d on page 70, and the common name, 'white alpine everlasting', is aptly applied to it.

Conservation Status: Although *Xerochrysum collierianum* is uncommon and confined to a small number of mountain summits and ridges, more than half of the known occurrences are in national parks or other reserved lands. There are substantial populations in Cradle Mountain-Lake St Clair National Park and in Franklin-Gordon Wild Rivers National Park.

Representative specimens examined (all at HO), listed in sequence from north to south: St Valentines Peak 1080 m, 17 i. 1980, *S.J. Jarman s.n.* (HO *411428*); St Valentines Peak, 17 i. 1980, *G. Kantvilas s.n.* (HO *506944*); Mt Roland summit 1230 m, ii. 1906, *L. Rodway 395* (HO *12378*); Mt Roland near summit 1230 m, 2 iv. 1991, *P. Collier 5192* (HO *142597*); Round Mount, iii. 1971, *K. Gillanders s.n.* (HO *34891*); Mt Claude Lookout 690 m, 1 xii. 2001, *A.M. Buchanan 15908* (HO *516530*); Mt Claude 840 m, 04 iv. 1988, *A. Moscal 15683* (HO 407162); Gog Range 700 m, 1 v. 1983, *A. Moscal 2245* (HO *99492*); Dove River - Knyvet Falls track c. 4 km N of Cradle Valley 850 m, 27 i. 1956, *A.M. Gray 641* (HO *81277*); Mt Remus 1075 m, 16 i. 1988, *P. Collier 3097* (HO *110066*); Mt Murchison 1250 m, 13 ii. 1995, *G. Kantvilas s.n.* (HO *411359*); Raglan Range 1000 m, 26 i. 1994, *S.J. Jarman s.n.* (HO *307381*); Mt Jukes, West Coast Range, ii. 1973, *D.A. & A.V. Ratkowsky s.n.* (HO *52418*); Frenchmans Cap, 13 iii. 1977, *D. Wythes s.n.* (HO *58192*); The Spires, N of Lake Gordon 1000 m, 13 ii. 1991, *P. Collier 5178* (HO *142583*); Summit of Ragged Range 760 m, 28 i. 1995, *G. Kantvilas s.n.* (HO *411639*).

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Muelleria 20: 53–66 (2004)

Three new genera of Australian Astereae (Asteraceae)

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Abstract

Three new genera of Australian Asteraceae are described and illustrated. *Allittia* P.S.Short from south-eastern Australia contains two species, *A. cardiocarpa* (F.Muell. ex Benth.) P.S.Short *comb. nov.* and *A. uliginosa* (G.L.R.Davis) P.S.Short *comb. nov.*, which were previously included in *Brachyscome s. lat. Hullsia argillicola* P.S.Short, *gen. & sp. nov.* is endemic to northern Australia where it grows in seasonally inundated, clay soils. *Pembertonia* P.S.Short accommodates a species from Western Australia which until now has been known as *Brachyscome latisquamea* F.Muell.

Introduction

Contrary to the impression that may have been given in papers such as Watanabe *et al.* (1996) I believe that a number of genera should be segregated from *Brachyscome* Cass. *s. lat.* (Short 1999). Containing about 100 species it has been the dumping ground for Australian asteroid species that either lack a pappus of have a short crown of bristles or bristle-like scales. Species have been referred to *Brachyscome* with little consideration of other morphological and anatomical attributes and I have no doubt that segregate genera should be recognised.

With the view to gaining a thorough overview of the variation in Australian Astereae, something that is necessary if some consistency in generic concepts is to be reached, a large character set for approximately 200 species has been compiled. Preliminary cladistic analyses have also been carried out with a view to eventually presenting a conspectus of Australian genera, including *Brachyscome*. This work involved checking and scoring more than 150 potentially useful morphological and anatomical characters. However, whether this work will be finalised remains to be seen; problems with homoplasy, coding, time and even doubts as to whether cladistics really offers acceptable answers (e.g. Brummitt 2002) are some of the factors which may mean that the project remains incomplete. I also suspect that without resorting to molecular analyses there will continue to be doubts as to the circumscription of *Brachyscome* and some of the segregate genera I intend to recognise. Unfortunately the published work utilizing nucleotide sequences of the chloroplast gene *mat*K (Denda *et al.* 1999) has not been of assistance. Apart from the absence of many species from the analysis the relationships as elucidated by this molecular information are simply not supported by morphological and anatomical data. The separation into separate clades of members of the *B. lineariloba* DC. complex is a prime example. Similarly, I find it impossible to reconcile the placement of *B. latisquamea* F.Muell., a species I here place in the monotypic genus *Pembertonia*, with *B. halophila* P.S.Short and *B. ciliocarpa* W.Fitzg. No reasons were given but Watanabe (pers. comm.) has, since publication, also described the data from restriction site analysis of chloroplast DNA (Watanabe *et al.* 1996) as being "no good". Most certainly, as with *mat*K results, the relationships suggested by the chloroplast DNA analyses are sometimes at extreme variance to those indicated by morphological and anatomical data and again there is inadequate sampling of species, with members of the *B. aculeata* (Labill.) Cass. ex Less. complex (i.e. *Brachyscome s. str.*) not included.

From having surveyed numerous species and characters it is evident that there will need to be considerable realignment of many taxa, not just those in *Brachyscome s.lat.* but also in both *Minuria* DC. and *Olearia* Moench. which are clearly not monophyletic genera.

Both the completion of a single major revision of *Brachyscome s.lat.* and the

finalization of a large cladistic analysis of Australian Astereae have become somewhat unrealistic tasks, or at least tasks that cannot be readily completed in a short time. I have therefore decided that it is best to publish some of the segregate genera that I now recognise in a series of papers when a revision of the component species of each genus is completed.

In this paper I formally describe three new genera, the ditypic genus *Allittia* to accommodate *B. cardiocarpa* F.Muell. ex Benth. and *B. uliginosa* G.L.R.Davis, and the two monotypic genera, *Hullsia* and *Pembertonia*. The last genus incorporates the species currently known as *B. latisquamea* while *Hullsia* accommodates a previously undescribed species.

Taxonomy

Allittia P.S.Short, *Gen. nov.*

Herbae perennes sine rhizomatibus plerumque foliis basalibus. *Folia* integra vel pinnatisecta lobis 1–6 plerumque glabra sed foliis infernis cum pilis longis grossis septatis subbruneis basibus. *Scapi* foliis paucis, scapo florenti quam foliis longiore. *Capitula* solitaria heterogama radiata. *Bracteae* involucri in seriebus duabus distinctis, marginibus scariosis glabris. *Receptaculum* convexum vel aliquantum conicum glabrum alveolatum. *Flosculi radii* feminei, corolla alba vel subcyanea. *Flosculi disci* bisexuales corolla lobis 5, lutea. *Stamina* 5 antheris cum appendici. *Stylus* appendicibus sterilibus apicalibus deltatis vel triangularibus atque longitudine partem stigmaticam aequantibus vel ea brevioribus. *Cypselae* homomorphae tenues bruneae concolores corpore fructus laevis vel minute tuberculato, cristis longitudinibus atque exterioribus aliformibus, glabris; extensiones aliformes marginibus integris vel incisuris indistinctis, margines pilis biseriatis eglandulatis curvatis vel apicibus vix involutis, carpopodium adest. *Pappus* setis 10–15 squamiformibus erectis.

Typus: *Allittia cardiocarpa* (F.Muell. ex Benth.) P.S.Short.

Perennial, non-rhizomatous, tufted (scapiform) herbs with mostly basal leaves. *Leaves* entire or pinnatisect and with 1–6 lobes, mainly glabrous but at least the lower leaves with long, coarse, septate, brownish hairs at the base. *Scapes* with some leaves which reduce in length up the scape, the flowering scape longer than the leaves. *Capitula* solitary, heterogamous, radiate. *Involucral bracts* in c. 2 distinct rows, margins scarious, glabrous. *Receptacle* convex or somewhat conical, glabrous, alveolate. *Ray florets* female. *Ray corolla* white or bluish. *Disc florets* bisexual; corolla 5-lobed, yellow. *Stamens* 5, anthers with an apical appendage. *Style* with sterile apical appendages shortly deltate or triangular and about the length or shorter than the stigmatic portion. *Cypselas* homomorphic, thin, brown, concolorous; fruit body smooth or minutely tuberculate and barely to well-defined by longitudinal ridges associated with the vascular traces, glabrous; non-vascular longitudinal ridges absent; wing-like extensions not swollen and with entire or barely notched edges, the edges with biseriate, eglandular, curved or sometimes slightly inrolled hairs; carpopodium present. *Pappus* of c. 10–15 scale-like, somewhat erect bristles which are connate or barely so at the base, the bristles to c. 0.4 mm long. *Chromosome number*: $x = 9$.

Distribution: South-eastern, mainland Australia and Tasmania.

Etymology: The name commemorates William Allitt. He collected herbarium specimens, including the new lectotype specimen of *Brachyscome cardiocarpa*, in the south-west of Victoria while he was curator of the botanic gardens at Portland from the 1860s to the 1880s (Willis 1949).

Notes: Both species of *Allittia* have laterally compressed, thin cypselas, which is characteristic of a number of other species in *Brachyscome s. lat.*, but they differ from

these other species by having long, coarse, septate, brownish hairs at the base of the leaves. The fact that they are non-rhizomatous, tufted, perennial herbs also distinguishes them from other species of *Brachyscome s. lat.* with thin cypselas.

Immature fruit of *A. cardiocarpa* and sometimes mature fruit of *A. uliginosa* may exhibit two longitudinal ridges on each lateral face. Cleared fruit show that these ridges are associated with vascular traces in the pericarp and as such they are not considered to be homologous with the longitudinal ridges found in some other species of *Brachyscome s. lat.*

Key to Species

1 Leaves usually entire, to 30 cm long, 0.1–0.3 cm wide, rarely with several linear lobes ..... ***A. cardiocarpa***

1: Leaves entire or pinnatisect, the latter common and with 1–6 lobes, all leaves to c. 11 cm long, (0.2) 0.4–1.4 cm wide ..... ***A. uliginosa***

Allittia cardiocarpa (F.Muell. ex Benth.) P.S.Short, *comb. nov. Brachyscome cardiocarpa* F.Muell. ex Benth., *Flora austral.* 3: 517 (1867) ("*Brachycome*"). Type citation: "Victoria. Swamps of Gipps' Land, *F. Mueller*; Heaths, Glenelg River, *Robertson*; Portland, *Allitt*. Tasmania. Mount Wellington, Formosa, etc., generally growing in water, *J. D. Hooker* and others. S. Australia. Rivoli Bay, *C.*[sic] *Mueller*." Lectotype (*lecto nov.*, here chosen): Portland, *W. Allitt 5* (MEL 220866), see below. Remaining syntypes: Glenelg [River], *Anon.*, presumably Robertson (K); Rivoli Bay, Oct. 1848, *F. Mueller* (MEL 220867); swamps of Gippsland, *?F. Mueller*, (K). Uncited specimens or duplicates of specimens seen by Bentham: South Esk, Tasmania, 10 Dec., *C. Stuart 114* (MEL 220868); Swamps near Perth, Tas., Dec. 1849. *C. Stuart* (MEL 220869); Van Diemen's Land, *C. Stuart* (MEL 220865, MEL 220870, both ex herb. Sonder).

[*Brachyscome linearifolia* auct non DC., Hook.f., *Flora Tasman.* 1: 185 (1856).]
Perennial herb, erect, to 45 cm tall, mainly glabrous, basally surrounded by bases of former leaves. *Leaves* mainly radical, linear, usually entire, 4–30 cm long 0.1–0.3 cm wide, very rarely with several small linear lobes, mainly glabrous but at least the lower leaves with long, coarse, septate, brownish hairs at the base. *Scapes* sometimes shorter but usually longer than the leaves, with some linear leaves which reduce in length towards the capitulum. *Involucre* c. 8–15 mm diam.; bracts c. 40–48, in at least 2 distinct rows, somewhat oblong or obovate to oblanceolate, 4–8.8 mm long, 0.8–3.1 mm wide, glabrous. *Receptacle* subconical, glabrous, alveolate. *Ray florets* 54–77; corolla 10.6–16.2 mm long, apically not lobed or barely 2-lobed, with (3) 4 or 5 (6) veins, white or mauve. *Disc florets* 150–226; corolla tube 5-lobed, 2.8–3.7 mm long, yellow. *Stamens* 5; anthers 1.4–1.93 mm long; microsporangia 1.1–1.5 mm long; apical appendage 0.26–0.43 mm long. *Pollen grains* c. 3700–4600 per floret. *Style* with sterile apical appendages triangular and slightly longer than the stigmatic portion. *Cypselas* widely obovate to obovate, 2.4–3.4 mm long, 1.8–2.3 mm wide, brown, concolorous or discolorous, with the wing-like margins paler than the fruit body; fruit body smooth or minutely tuberculate and not or more or less well-defined by longitudinal ridges associated with the vascular traces, glabrous or each tubercle with a hair; wing-like margins non-swollen and with entire edges, the edges with biseriate, curved, eglandular hairs. *Pappus* of c. 10 scale-like, more or less erect bristles 0.1–0.4 mm long, connate at the base, not exceeding the apical notch of the cypsela. *Chromosome number*: $n = 18$. (Fig. 1, a–g).

Distribution: South-east South Australia, much of Victoria, extreme south-east of New South Wales, and Tasmania. I have not seen specimens from New South Wales but the illustration and description of *A. cardiocarpa* in Everett (1992, p. 165) are of this species.

Figure 1. a–g. *Allittia cardiocarpa*. **a.** habit (*Moscal 3490*, *Short 3238*); **b.** involucre showing two rows of bracts (*Short 3238*); **c.** ray floret with immature ovary, the pappus not visible (*Short 3238*); **d.** mature fruit (*Short 3919*); **e.** disc corolla (*Short 3238*); **f.** anther (*Short 3238*); **g.** style, showing stigmatic portion and externally papillate appendage (*Short 3238*). **h–i.** *Allittia uliginosa*. **h.** habit (*Albrecht 2799*); **i.** base of leaf showing characteristic coarse hairs (*Albrecht 2799*). Scale bars: a, h = 3 cm; b = 5 mm; c, d, e, i = 2 mm; f, g = 0.5 mm.

Habitat: Grows in swampy areas, plants often being partly immersed in water, and commonly associated with sedges. Collections from near coastal regions suggest that it may have some tolerance to salinity.

Chromosome Number: A chromosome number of $2n = 36$ was reported by Watanabe *et al.* (1996) from two populations in south-west Victoria, indicating that the species is a tetraploid. Reports by Smith-White *et al.* (1970) of $2n = 18$ for a population of this species at Callemondah (A.C.T.) are erroneous. There are no other other records indicating that the species occurs there and the only vouchered specimens of *Brachyscome s. lat.* at SYD collected by Smith-White and his colleagues from this locality are of *Brachyscome scapigera* (Spreng.) DC.

Flowering Period & Reproductive Biology: Mostly flowers from about September to January but flowering specimens have been collected in other months. That the species commonly outcrosses is indicated by the large capitula and an average pollen:ovule ratio of 4286, determined from a single population, *Short 3238*.

Typification: Bentham did not specifically cite all specimens he examined when naming *B. cardiocarpa*, indicating by use of "etc." that he had seen collections from different localities in Tasmania and that they had been gathered by various collectors ("and others"). Davis (1948, p. 196) subsequently recorded that "specimens annotated by Mueller (South Esk River, 10.12.1849, C. Stuart) were nominated lectotype and lectoparatype ...". As will be evident from determinavit slips accompanying specimens at MEL I initially accepted Davis's choice of lectotype, believing that Bentham's broad reference in the protologue to unspecified collections from various localities in Tasmania, meant that, following Art. 9.17, the choice of Stuart's collection was not "in serious conflict with the protologue". However, Art. 9.10 states that a lectotype should be chosen from an isotype "if such exists, or otherwise a syntype if such exists [and] ... if no cited specimens exist ... from among the uncited specimens". Although there is no doubt that Bentham saw Stuart's collection it must be deemed to be an "uncited specimen", not a syntype specimen. I have therefore chosen a syntype specimen, "Portland, *Allitt*", as the new lectotype of the name *Brachyscome cardiocarpa*.

Selected Specimens: SOUTH AUSTRALIA: Mary Seymour Conservation Park, 13 Oct. 1982, *N.N. Donner 9301* (AD); VICTORIA: c. 6.5 km W of Poolaijelo, 27 Sept. 1988, *P.S. Short 3238* (MEL); c. 4 km ESE of Dundonnel, 8 Oct. 1991, *N.G. Walsh 3112* (MEL); TASMANIA: Wineglass Bay, beside lagoon behind the beach, 21 Nov. 1981, *A.M. Buchanan 626* (HO).

Allittia uliginosa (G.L.R.Davis) P.S.Short, *comb. nov.* *Brachyscome uliginosa* G.L.R.Davis, *Proc. Linn. Soc. New South Wales* 79: 203, figs 1–4 (1955). Type citation: "*Holotype*: Heathland at eastern foot of Black Range, Western Grampians Region, Victoria, 2.11.1948, J. H. Willis (MEL). Paratypes: Two. *Loc. cit.* (MEL)." Holotype: Heathland swamp at eastern foot of Black Range (near "The Pass", 3 miles NE of Mt Byron Trig), western Grampians region, Vic., 2 Nov. 1948, *J. H. Willis* (MEL 220486 *p.p.*). Isotypes: MEL 220486 *p.p.* (excluding holo.), MEL 220487 *p.p.* (excl. St John specimen).

Perennial herb, erect, to 35 cm tall, mainly glabrous, basally surrounded by leaf bases of former leaves. *Leaves* mainly radical, oblanceolate, entire, 2–11 cm long, (0.2) 0.4–1.4 cm wide, or pinnatisect with 1–6 lobes, mainly glabrous but at least the lower leaves with long, coarse, septate, brownish hairs at the base. *Scapes* when flowering longer than the leaves, with some oblanceolate or almost linear leaves which reduce in length toward the capitulum. *Involucre* c. 5–8 mm diam.; bracts 21–40, in c. 2 distinct rows, obovate, 2.5–4.6 mm long, 1.1–2.1 mm wide, glabrous. *Receptacle* convex, glabrous, alveolate. *Ray florets* 30–54; corolla 5.4–9.1 mm long, 1–1.9 mm wide, barely 3-lobed, with 4 veins, white or bluish. *Disc florets* 37–88; corolla tube 5-lobed, 1.8–2.7 mm long, yellow.

Stamens 5; anthers 1.04–1.32 mm long; microsporangia 0.83–1.05 mm long; apical appendage 0.18–0.29 mm long. *Pollen grains* c. 2000–3600 per floret. *Style* with sterile apical appendages shortly deltate and shorter than the stigmatic portion. *Cypselas* widely obovate, 1.5–2 mm long, 1.2–1.4 mm wide, brown, concolorous; fruit body smooth and more or less well-defined by longitudinal ridges associated with the vascular traces, glabrous; wing-like margins non-swollen and with entire or barely notched edges, the edges with biseriate, curved, eglandular hairs or sometimes the apices of the hairs slightly inrolled. *Pappus* of c. 10–15 scale-like, somewhat erect bristles 0.2–0.4 mm long, barely (or not?) connate at the base, usually exceeding the often barely formed apical notch formed by the wings. *Chromosome number*: $n = 9$. (Fig. 1, h–i).

Distribution: Southern Victoria, extending west from the Dandenongs to areas such as the Brisbane Ranges, Mt Langi Ghiran, the Grampians, and beyond to south-eastern South Australia, including Kangaroo Island.

Habitat: Often in inundated *Eucalyptus* woodland, swamps and wet heathland but sometimes in drier rocky areas in sclerophyll forest. When observed at the same locality (*Short 3237 & 3238*) as its congener this species was growing on the edge of a swamp dominated by *Chorizandra cymbaria* R.Br. and extended into surrounding heathland but *A. cardiocarpa* was growing in the swamp.

Chromosome Number: A chromosome number of $n = 9$ was recorded by Smith-White *et al.* (1970) from plants (e.g. *S. Smith-White & C.A. Carter 4660*, SYD) from the Black Range, Grampians, Victoria.

Flowering Period and Reproductive Biology: Flowering has been recorded for Sept.–Nov. and June. The prominent capitula indicate that plants are cross-pollinated but an average pollen:ovule ratio of 1586, determined from *Short 3237*, is not particularly high for species with such large capitula, suggesting that plants may be self-compatible.

Conservation Status: Widespread and not regarded as endangered or vulnerable.

Selected Specimens: SOUTH AUSTRALIA: Karatta, c. 20 km W of Vivonne Bay, Kangaroo Island, 9–17 Nov. 1886, *Anon 118* (AD 97411131); Hundred of Coles, 30 km SW of Naracoorte, 19 Sept. 1963, *D. Hunt 1607* (AD); VICTORIA: c. 3.5 km due SE of Gotons Gorge, 10 Sept. 1986, *D.E.Albrecht 2826* (MEL); ½ mile N of Dergholm to Penola road, immediately E of Vic./S.A. border, 9 Nov. 1964, *A.C Beauglehole 19845* (MEL).

Hullsia argillicola P.S.Short, *Gen. & sp. nov.*

Brachyscome A58350 Newcastle Waters Station, Dunlop *et al.*, Checkl. Vasc. Pl. N. Territory, Australia 21 (1995); Albrecht *et al.*, Vasc. Pl. Checkl. S. Bioreg. N. Territory 66 (1997).

Herba perennis, subsucculenta, radice palari. *Axes majores* ascendentes ad erecti, 15–100 cm longi, cavi, striati, glabri, subglauci. *Folia* alterna sessilia, integra anguste elliptica vel linearia, apicibus acutis, 3–10 cm longa, 0.2–0.9 cm lata, subglauca et subsucculenta, folium omne costa prominenti et costis duabus lateralibus prominentibus. *Capitula* solitaria, heterogama, radiata. *Involucrum* c. 8–12 mm diametro. *Bracteae* multiseriatae, inequales, ovatae usque lanceolatae, ellipticae vel lanceolatae, 2.8–3.5 mm longae, 0.5–0.8 (1.2) mm latae; costa divisa et basi costa singulari cartaginae crescit; margines bractearum anguste hyalini; bracteae totae glabrae vel pilis minutis glanduliferis ad margines dispersis, eae post fructificantes valde reflexae. *Receptaculum* planum sed ubi bracteae reflexae apparenter concavum, epaleatum. *Flosculi radii* feminei, plures seriati, c. 140–180; corolla 5.5–7 mm longa, 0.7–0.9 mm lata, venarum 3 vel 4, apicibus brevibus lobis 2 vel 3, alba. *Flosculi disci* masculi, c. 100–150. *Corolla disci* flava; tubus 2.5–3.5 mm longus, distincto limbo, pagina exterior pilis biseriatis; lobi 5, 0.7–1.1 mm longi. *Stamina* 5; antherae 1.6–2 mm longae, ecaudatae, breviter calceratae, unaquaeque appen-

Figure 2. *Hullsia argillicola*. **a.** habit (*Wardell-Johnson 23*); **b.** mature capitulum showing receptacle (*Risler 445*, holo.); **c.** male disc floret with the sterile style and anthers visible (*Risler 445*, holo.); **d.** anther with sterile apical appendage (*Latz 6012*); **e.** mature cypsela showing the annular carpopodium (*Risler 445*, holo.). Scale bars: a = 2 cm; b = 1 mm; c, e = 1 mm; d = 0.5 mm.

dicula apicali sterili; microsporangia 1.1–1.4 mm longa, contextus in endothecio radiale incrassatus; appendiculis apicalibus plus minusve triangularibus, 0.33–0.45 mm longis, cellulae radiate incrassatae; collum fili plus minusve in ambitu rectum. *Stylus* breviter bilobatus ad apicem. *Cypselae* homomorphae, laterale complanatae, obovatae, 2.7–3.1 mm longae, 1–1.4 mm latae, glabrae, laeves, leviter viscidae, brunneae; carpopodium annulare, c. 0.5 mm latum; pericarpii sclerenchyma in fasciculis vascularibus restrictum; facibus vascularibus 2; testa cellulis manifeste incrassata. *Pappus* absens.

Holotypus: Alexandria Station, 1 km SW of No. 16 Bore, 19°15'27"S, 136°38'19"E., 19 July 2000, *J. Risler 445 & R. A. Kerrigan* (DNA D0142120). *Isotypi*: AD, BRI, CANB, K, MEL, MO, NSW, PERTH, S.

Perennial herb, subsucculent, with a well-developed tap root, may possibly sucker. *Stem* and branches ascending to erect, 15–100 cm long, hollow, striated, glabrous, somewhat glaucous. *Leaves* alternate, sessile, entire, narrowly elliptic or linear, apex acute, 3–10 cm long, 0.2–0.9 cm wide, somewhat glaucous and succulent, with a prominent mid-vein and with two prominent lateral mid-veins extending from the base. *Capitula* solitary, heterogamous, radiate. *Involucre* c. 8–12 mm diam. *Bracts* multiseriate and in rows of unequal length, ovate to lanceolate, elliptic or lanceolate, 2.8–3.5 mm long, 0.5–0.8 (1.2) mm wide; stereome divided and basally with a single main vein, becoming cartilaginous; margins narrowly hyaline; entire bracts glabrous or with scattered, minute, glandular hairs on the margins, the bracts strongly reflexed after fruiting. *Receptacle* flat but becoming concave when bracts reflex, epaleate. *Ray florets* female, several seriate, c. 140–180 per capitulum; corolla 5.5–7 mm long, 0.7–0.9 mm wide, 3- or 4-veined and apically shortly 2 or 3-lobed, white. *Disc florets* male, c. 100–150 per capitulum. *Disc corolla* yellow; tube 2.5–3.5 mm long, with a distinct limb, externally with biseriate hairs; lobes 5, 0.7–1.1 mm long. *Stamens* 5; anthers 1.6–2 mm long, ecaudate, shortly calcerate, each with a sterile apical appendage; microsporangia 1.1–1.4 mm long, endothecial tissue radially thickened; apical appendage more or less triangular, 0.33–0.45 mm long, the cells with radial thickening; filament collar more or less straight in outline. *Style* shortly bilobed apically. *Cypselas* homomorphic, laterally flattened, obovate, 2.7–3.1 mm long, 1–1.4 mm wide, glabrous, smooth but slightly viscid, brown; carpopodium annular, c. 0.5 mm wide; pericarp sclerenchyma restricted to the vascular bundles; vascular bundles in pericarp 2; testa cells with prominent u-shaped thickening. *Pappus* absent. (Fig. 2).

Distribution: Confined to northern Australia, with all but one collection from the Northern Territory (between 17° and 21° S). The remaining collection is from Kununurra, Western Australia. Within the N.T. it has been collected at Birrindudu Station near the W.A. border but otherwise all specimens are from the Barkly Tablelands and adjoining country.

Habitat: The species is recorded from heavy clay soils in seasonally inundated regions, e.g. *Eucalyptus microtheca* F.Muell. swamps, perennial tussock grassland with scattered coolibah, and cracking clay plains dominated by annual herbs and grasses. The type specimen, from a heavily grazed paddock, was associated with a species of *Panicum*, *Cullen cinereum* (Lindl.) J.W.Grimes, *Goodenia straugfordii* F.Muell., *Haloragis glauca* Lindl. and *Teucrium integrifolium* F.Muell. ex Benth.

Reproductive Biology: This is a monoecious species. A pollen:ovule ratio of 5577 was determined from *Latz 6012* for a single capitulum with 143 female florets and 136 male florets. This value is indicative of a high degree of, and perhaps obligatory, outcrossing. Cross-pollination is presumably enhanced by the fact that anthers are almost totally exserted from the corolla tube at anthesis.

Etymology: The generic name commemorates an early Top End collector with the surname of Hulls, a person who in Bentham's *Flora australiensis* is accredited with having gathered no fewer than 27 collections from Escape Cliff and 11 from Adam Bay. These

included syntype specimens of at least nine specific or infraspecific names. As far as I can ascertain the collector was Charles Hulls (his surname in *Flora australiensis* sometimes spelt as "Hulse" or "Hullse") who was a member of John McKinlay's party which in 1866 unsuccessfully attempted a journey from Escape Cliff to the Liverpool River (Lockwood 1995).

The specific epithet is in reference to the clay soils in which the species grows.

Conservation Status: Following the IUCN Red List Categories Version 3.1 the species is currently ranked in the N.T. as "Data Deficient".

There are 11 collections from the Barkly Tablelands and adjacent areas and this suggests that the species is reasonably common. However, on a handwritten and unsigned note that accompanies *Henshall 2686* it is recorded that analyses showed the plant to have a percentage Dry Matter Digestibility (DMD) of 72.5%, a phosphorous content of 0.25% and a crude protein level of 17.1%. The DMD is an estimate of a plant's ability to supply energy and the high rate obtained is consistent with a further annotation on the same specimen that the species is heavily grazed by cattle. It was also noted that plants at the type locality were eaten by livestock (Kerrigan & Risler, pers. com.). Thus, its long-term survival may be dependant on excluding cattle from some populations.

Notes: Early collections of *Hullsia* were referred to the genus *Brachyscome*, in particular to *B. basaltica*, a species to which it bears a superficial resemblance. Its referral to the genus reflects the fact that there has been a common practice since Bentham (1867) to simply refer herbaceous members of the Astereae with no pappus, or an apparently reduced pappus, to *Brachyscome* with little consideration of other characters.

Hullsia argillicola is distinguished from all members of *Brachyscome s. lat.* by the possession of male, not bisexual, disc florets, and from most species by the multiseriate involucre of bracts, the bracts being manifestly of different lengths, not of equal length. The combination of entire leaves and erect habit are features which suggest affinities with *B. basaltica*. It not only differs from that species in the aforementioned characters of the disc florets and bracts but also in cypsela morphology; in *B. basaltica* they are tuberculate and have biseriate curved hairs.

The possession of male disc florets suggests affinities with genera such as *Calotis*, *Lagenophora*, *Minuria* and *Solenogyne*. It is readily distinguished from *Calotis* which, along with *Erodiophyllum* and perhaps *Achnophora* and *Ceratogyne*, seem to form a discrete group within the Australian Astereae that is characterised by having fruit with pericarpic appendages. Such appendages superficially look like, and are usually, but erroneously, described as pappus elements. Affinities with species currently included in *Minuria*, undoubtedly not monophyletic, seem to be remote. All species in *Minuria s. lat.* are characterised by the possession of pappus bristles and have different fruit morphologies. Affinities with *Lagenophora* and *Solenogyne*, in which the species are stoloniferous scapose or scapiform herbs, also seems to be remote.

The species has a well-developed tap root and although some plants seen by me are relatively small there is no doubt that *H. argillicola* is a perennial.

Specimens Examined: WESTERN AUSTRALIA: Ord Irrigation Area Block 111, in Kununurra clay; 23 July 1980, *I. Wardell-Johnson 23* (DNA, 2 sheets); NORTHERN TERRITORY: Helen Springs, 300 m W of no. 14 bore, 13 May 1999, *C. Brock 27* (DNA); Birrindudu Station, 18 June 1994, *J.L. Egan 4247* (DNA); Brunchilly Station, 5km E of 13 bore, 13 March 1979, *T.S. Henshall 2578* (AD, DNA, MEL, PERTH); Newcastle Waters Station, 7 km E of no. 7 bore, 14 March 1979, *T.S. Henshall 2583* (DNA, MEL); Anthony's Lagoon Station, 9 km S of Beef Road crossing, 18 March 1979, *T.S. Henshall 2686* (CANB, DNA, NSW); A-bore, Newcastle Waters Station, 31 May 1975, *P.K. Latz 6012* (AD, DNA); Kennedy Creek, 84 km N of Barkly Hmsd, 9 Sept. 1995, *P.K. Latz 14538* (DNA, NT); Coolabah Bore, Mittibah Station, 17 July 2001, *C.P. Mangion 1521 & J.A. Risler* (DNA, NT); Avon Downs, 2 km N of no. 24 Bore, 1 Aug. 2001, *J. Risler 1057 & A. Duguid* (DNA, NT); No. 18 Bore, Mungabroom Station, 27 Aug. 1987, *B.W. Strong 1032* (DNA); Brunchilly Station, 15 Feb. 1979, *L. Ulyatt 112* (BRI, DNA).

Pembertonia P.S.Short, *Gen. nov.*

Brachyscome sect. *Heteropholis* F.Muell., Fragm. 11: 16 (Mar. 1878), *nom. inval.*

Planta frutex perennis scandens glaber. *Folia* alterna, sessilia, integra, plerumque linearia vel lineo-oblanceolata vel lineo-elliptica sed nonnihil curvata, viridia, subsucculenta. *Capitula* solitaria, heterogama, radiata; bracteae involucri in verticillis duobus imbricatae herbaceae, bracteae externae valde convexae quam illae planae vel convexae verticilli interni breviores, bracteae omnes glabrae venis 4–8 e basibus. *Receptaculum* convexum epaleatum glabrum. *Flosculi radii feminei*, corolla plerumque alba vel rosea raro submalvina vel subpurpurea; pars tubularis pilis biseriatis glandulis; ligula venis lobis indistinctis. *Flosculi disci* numerosi, hermaphroditi; corolla flava lobis 5, pilis dispersis glandulis biseratis. *Stamina* 5; antherae ecaudatae connectivo vel non vel vix microsporangio longiore: contextus endothecii radiale incrassatus. *Styli* brachia conspicua, plus minusve oblonga. *Cypselae* homomorphae, lateraliter compressae tenues, quasi obovatae, stramineae, marginibus aliformibus atque fructu interdum discoloribus; apex incisurus; pericarpus aliquot fascibus vascularibus in extensioribus aliformibus, canalibus secretoriis nullis. *Pappus* minutus.

Typus: *Pembertonia latisquamea* (F.Muell.) P.S.Short.

Perennial, sprawling or scandent, glabrous shrub. *Leaves* alternate, entire, commonly linear, linear-oblanceolate or linear-elliptic but often somewhat curved, green, slightly succulent. *Capitula* solitary, radiate, heterogamous; involucral bracts in 2 rows, overlapping, herbaceous, the outer c. 5 bracts markedly convex and shorter than those of the inner row, the inner bracts flat to convex, all bracts glabrous and with *c.* 4–8 veins from the base. *Receptacle* convex, naked, glabrous. *Ray florets* female. *Corolla* usually white or pink, rarely somewhat mauve or purplish; tubular part with biseriate glandular hairs; ligule with 4–9 veins, with 2 or 3 indistinct lobes. *Disc florets* numerous, bisexual, 5-lobed, yellow, externally with scattered biseriate glandular hairs. *Stamens* 5; anthers not tailed, the connective not or barely exceeding the microsporangium; endothecial tissue with radial thickening; filament collar straight in outline and basally not thicker than the filament. *Style arms* conspicuous, more or less oblong. *Cypselas* homomorphic, laterally compressed and thin, symmetrical or slightly asymmetrical but essentially obovate in outline, pale brown, the wing-like margins and fruit body sometimes slightly discolorous; apically notched; basally with a region of smaller cells concolorous with the rest of the fruit; pericarp with several vascular bundles in each of the wing-like extensions, secretory canals absent. *Pappus* an uneven rim c. 0.1 mm high. *Chromosome number*: $n = 9$.

Distribution: A monotypic genus confined to Western Australia.

Etymology: The generic name commemorates Pemberton Walcott who joined Francis Gregory's expedition to the north-west coast of Australia in 1861 "as a volunteer for the collection of specimens of natural history and botany" (Gregory 1884, p. 53).

Nomenclature: Mueller, when describing and naming the species *Brachyscome latisquamea*, referred it to a new section, sect. *Heteropholis* F.Muell., placing this name in brackets under the binomial and then proceeding to give a description of the plant. The description is in two parts, the upper part with the more diagnostic features, distribution and collection data and the lower being a more detailed description. However, Mueller commonly compiled his species descriptions in this manner throughout the volumes of the *Fragmenta* and thus I believe it erroneous to treat the first part of the description as a diagnosis of the Sectional name. For this reason, following Article 41.2, I regard the sectional name to be invalid as a separate description or diagnosis was not provided.

Notes: At the interface of the corolla tube with the cypsela there is a minute and uneven rim of cells which Davis (1948, p. 229) considered to be a pappus. It is also described as a pappus in the above description but whether it is equivalent to the pappus

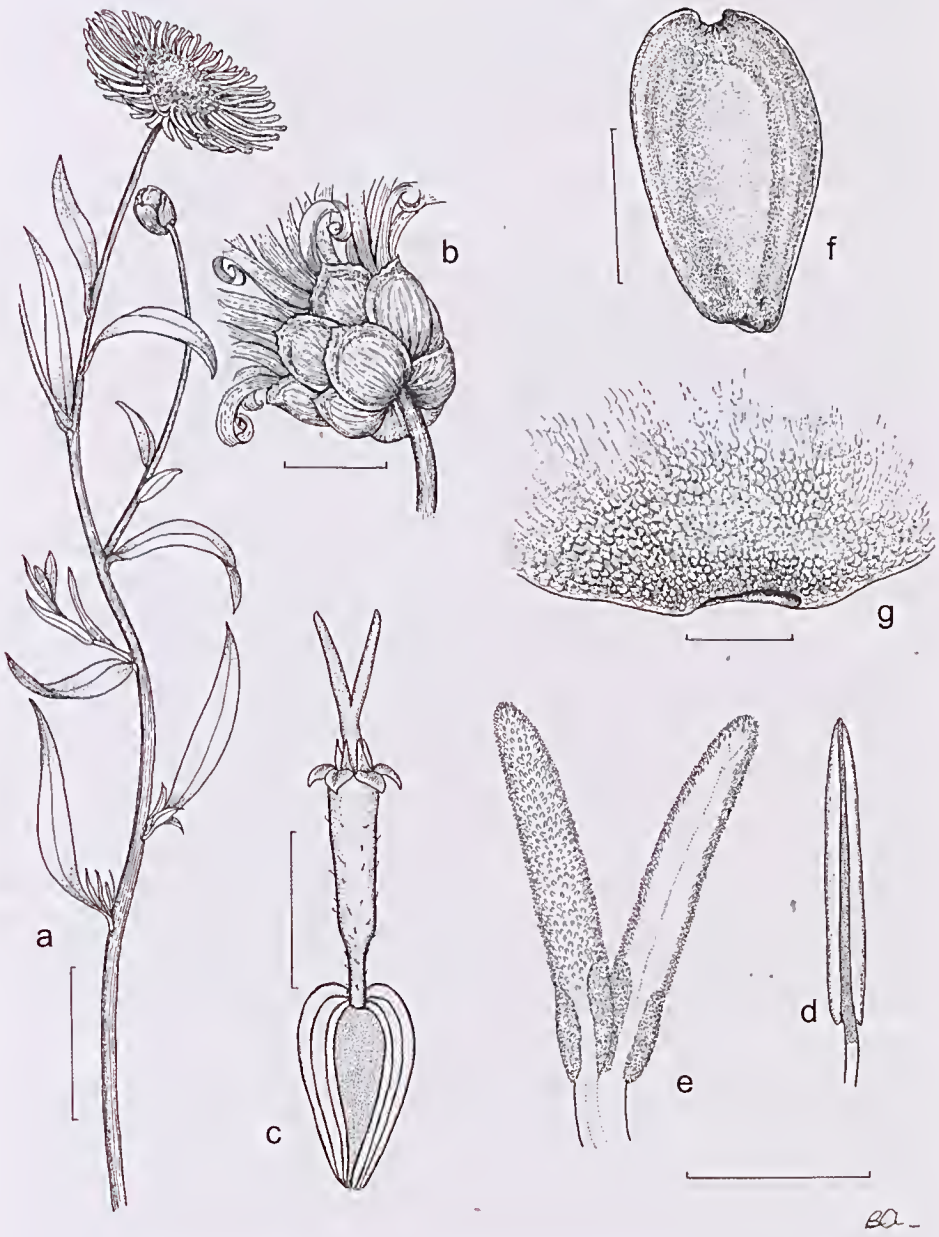

Figure 3. *Pembertonia latisquamea*. **a.** flowering branch (*Short 2503*); **b.** capitulum, showing two rows of involucral bracts (*Short 2470*); **c.** disc floret with vascular traces visible in the pericarp of the immature ovary (*Short 2470*); **d.** anther, showing virtual lack of an apical appendage (*Short 2470*); **e.** style arms from disc floret showing stigmatic part and the almost oblong appendages (*Short 2470*); **f.** mature cypsela (*Short 2054*); **g.** base of mature cypsela (*Short 2054*). Scale bars: a = 3 cm; b = 10 mm; c = 3 mm; d, e = 1 mm; f = 2 mm; g = 0.3 mm.

of other species of asteroid daisy is not clear to me. It may be that the cells of this "pappus" should be considered as part of the cypsela or part of the dehiscent tissue of the cypsela-corolla interface.

The cypsela morphology alone distinguishes this species from all others in *Brachyscome s. lat.* and indeed from other members of the Australian Astereae and, as far as I am aware, from non-Australian species. No other species has large, flattened, glabrous fruit with multiple vascular strands in the pericarp.

Pembertonia latisquamea (F.Muell.) P.S.Short, *comb. nov. Brachyscome latisquamea* F.Muell., *Fragm.* 11: 16 (Mar. 1878). Type citation: "Ad sinum marinum Shark-Bay in locis tempore pluviali humidis; F.M. Prope Champion-Bay, C. Gray." Lectotype (Davis 1948, p. 228, fig. 110): Shark Bay, [Oct. or Nov. 1877], *F. Mueller s.n.* (MEL 239618, *p.p.*). Isolectotypes: MEL 239618 *p.p.*, excluding lectotype. Remaining syntype: Champion Bay, *Charles Gray 67* (MEL 239619).

Perennial, sprawling or scandent and to c. 1.5 m tall shrub, glabrous. *Leaves* alternate, entire, linear, linear-oblanceolate or linear-elliptic but often somewhat curved, 10–80 mm long, 1–13 mm wide, green, slightly succulent. *Capitula* c. 14–18 mm diam. *Capitular bracts* c. 12–16, in about 2 rows, overlapping, obovate to widely obovate, 9–12 mm long, 3.5–8.5 mm wide, herbaceous, with the outer c. 5 bracts markedly convex and shorter than those of the inner row, the inner bracts flat to convex, all bracts glabrous, often slightly succulent, with *c.* 4–8 veins from the base. *Receptacle* convex, naked, glabrous, with rounded bumps indicating the position of the florets when fresh but appearing slightly pitted when dry. *Ray florets* 35–50. *Ray corolla* 22–37 mm long, 2.7–3.7 mm wide, commonly white or shades of pink, more rarely somewhat mauve or purplish; tubular part with biseriate glandular hairs; veins 4–9; apex not or barely 2 or 3-lobed. *Disc florets* c. 170–260, corolla tube 4.3–6 mm long, yellow, externally with scattered biseriate glandular hairs 0.5–1.2 mm long. *Stamens* 5; anthers with the microsporangium 1.65–2.25 mm long, apically rounded with the connective not or barely exceeding the microsporangium; endothecial tissue with radial thickening; filament collar straight in outline and basally not thicker than the filament. *Pollen grains* c. 5000–10000 per floret. *Style* 6.2–8.2 mm long; *arms* 1.8–2.8 mm long; appendages more or less oblong, 1.75–1.9 mm long.; stigmatic surface 0.6–0.7 mm long. *Cypselas* homomorphic, strongly laterally compressed and thin, symmetrical or slightly asymmetrical but essentially obovate in outline, 3–3.9 mm long, 1.6–2.8 mm wide, pale brown, the wing-like margins and fruit body not or slightly discolorous; apically notched; basally with a region of smaller cells concolorous with the rest of the fruit; pericarp with several vascular bundles in each wing-like extension, secretory canals absent. *Pappus* an uneven rim c. 0.1 mm high. *Chromosome number*: $n = 9$. (Fig. 3).

Distribution: Extends from approximately the Shark Bay region (including Dirk Hartog Island) to North West Cape, Western Australia and not recorded more than c. 50 km from the coast.

Habitat: Common in calcareous sand along the coast and associated with species such as *Spinifex hirsutus* Labill. but further inland in *Acacia* shrubland and *Atriplex* shrubland on red-brown sand.

Flowering Period & Reproductive Biology: The large capitula indicate that the species predominately cross-pollinates and this is supported by an average pollen:ovule ratio of 7021 determined from five capitula of *Short 2470*. The high value also suggests that the species is self-incompatible.

Collection data indicate that *P. latisquamea* commonly flowers between late July and the end of October but a flowering specimen (*A.S. George 2527*) from North West Cape was collected in early June and at Carnarvon flowering material has been collected in December (*W.V. Fitzgerald s.n.*, Dec. 1906).

Cytology: Turner (1970) recorded a chromosome number of n = c. 9 for this species. That the number is indeed n = 9 was subsequently determined by Carter (1978) and Watanabe *et al.* (1996). All populations examined for chromosome number determinations were gathered near Carnarvon and Pt Quobba.

Selected Specimens: WESTERN AUSTRALIA: 15.2 km N of Ningaloo homestead, 30 July 1980, *K.F. Kenneally 7354* (CANB, PERTH); Pt Quobba, 14 Oct. 1983, *P.S. Short 2054* (AD, MEL, PERTH); 2 km from Monkey Mia along road to Denham, 16 Aug. 1986, *P.S. Short 2470* (MEL, PERTH); 2 km E of Miaboola Beach, 9 Sept. 1976, *R. Story 8227* (CANB, PERTH); Exmouth, 5 Oct. 1975, *J.Z. Weber 4993* (AD, PERTH).

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Taxonomic studies of Australian *Senecio* (Asteraceae): 2. The shrubby, discoid species and the allied radiate species *Senecio linearifolius*

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Abstract

A morphological study of Australian shrubby, discoid *Senecio* has resulted in the recognition of one new species, *Senecio euclaensis* I.Thomps., one new subspecies, *S. anethifolius* DC. subsp. *brevibracteolatus* I.Thomps., and one new variety, *S. cunninghamii* DC. var. *flinderseusis* I.Thomps. In addition, *Senecio cunninghamii* DC. var. *serratus* M.E.Lawr. is elevated to the rank of species becoming *S. lanibracteus* I.Thomps. The shrubby, discoid species plus three radiate species are recognised here as forming a group. A key encompassing this group and the remaining discoid species in Australia is presented. One of the three radiate species, *Senecio linearifolius* A.Rich., is revised and nine varieties are described, seven of them new, and one a new combination. They are: var. *araclnoideus* I.Thomps., var. *dangareusis* I.Thomps., var. *denticulatus* I.Thomps., var. *gariwerdeusis* I.Thomps., var. *graniticola* I.Thomps., var. *intermedius* I.Thomps., var. *latifolius* I.Thomps, and var. *macrodontus* (DC) I.Thomps. A key to these varieties is presented.

Introduction

The shrubby, discoid species of *Senecio* in Australia appear to form a natural group and are endemic. Other features of this group include: a tendency to glaucosity, capitula in congested corymbiform clusters, slender capitula with relatively few phyllaries and florets, narrow-margined phyllaries convex and alternating with broad-margined phyllaries that commonly have narrow stereomes, stereomes with prominent resin ducts, and florets extending well above the phyllaries at anthesis. The capitula are showy and self-incompatible in contrast to the disciform species of *Senecio* in Australia with which they might be confused (Lawrence 1985a).

The taxonomic history of the discoid members of the group has been relatively straightforward. *Senecio odoratus* Hornem., *S. anethifolius* A.Cunn. ex DC., *S. cunninghamii* DC. and *S. hypoleucus* F.Muell. ex Benth. were described in the early to mid-1800s, *S. odoratus* var. *obtusifolius* J.M. Black was described in 1912, and *S. georgianus* DC. var. *latifolius* Black in 1929. Lawrence (1985b) elevated *S. georgianus* DC. var. *latifolius* to the rank of species as *S. gawlereusis* M.E.Lawr., and described two varieties, *S. cunninghamii* var. *serratus*, and *S. odoratus* var. *longifolius* M.E.Lawr. Taxonomic changes to and descriptions of species in this group are presented in the first part of this paper.

The shrubby, discoid group can also be considered to be part of a larger group including three radiate species, here informally named the Odoratus group. The three radiate species are *S. linearifolius* A.Rich., *S. garlandii* F.Muell. ex Belcher, and *Senecio behrianus* Sond. & F.Muell. ex Sond. The former two in particular are similar to the large-leaved, discoid species *S. odoratus* and *S. hypoleucus*., whereas the woolly capitulum of *S. behrianus* is reminiscent of the discoid species, *S. cunninghamii* var. *serratus* M.E.Lawr. The Odoratus group occurs in central and south-eastern Australia and occurs in a wide range of environments. *Senecio linearifolius* and *S. odoratus* occur further south and east than the other species and in more mesic environments.

Two of the radiate species of the Odoratus group, *S. garlandii* and *S. behrianus* do not form part of this taxonomic study, although they are included in the key. *Senecio garlandii* is an uncommon species occurring in southern New South Wales and recently recorded from north-eastern Victoria. *Senecio behrianus* was collected from several

localities in south-eastern Australia in the 19th century, but there were no records in the 20th century until discovered in north-central Victoria in the 1980s. It has recently been recorded from near Ballarat in south-central Victoria. The third radiate species, *Senecio linearifolius*, is a widespread, variable species and a taxonomic revision of this species is presented in the second part of this paper.

There are several discoid species endemic to Australia that do not conform to the Odoratus group. Two of these, *S. ramosissimus* DC. and *S. gilbertii* Turcz., occur in south-western Western Australia and are allied to *S. leucoglossus* F.Muell. a radiate species with 1–3 ray florets from the same region. These three species, all herbaceous perennials, are gynodioecious, i.e. some plants of a species have capitula with entirely bisexual disc florets (or 1–3 female in the case of *S. leucoglossus*), whereas other plants have capitula with entirely female florets. Two further discoid species, *S. georgianus* DC. and *S. helichrysoides* F.Muell., from eastern Australia, have not been collected since the 19th century. They appear closer to the disciform group, *e.g. S. quadridentatus* Labill., in terms of habit and capitular morphology. A third species, *Senecio interpositus* I.Thomps., is typically disciform but it appears to provide a link between *S. georgianus*, *S. helichrysoides* and the disciform group by being discoid in the Armidale area of New South Wales (Thompson 2004).

Materials and Methods

Herbarium specimens from AD, BRI, CANB, DNA, HO, MEL, NE, NSW, and PERTH, were examined. The circumscriptions of, and morphological variation within, previously recognised taxa was critically assessed and new taxonomic hypotheses developed and tested. Distribution maps were generated using ArcView computer program.

Terminology for descriptions and keys:

Mid-branch leaves refers to leaves in the middle third of the longer branches, i.e. not the shorter inflorescence branches.

Unit inflorescence here refers to the cluster of capitula at the end of axes where all the supporting inflorescence branches are leafless.

The diameter of the involucre is for unpressed specimens measured approximately mid-involucre. At this level the diameter is relatively constant.

Papillose hairs on achenes form longitudinal bands between the ribs and are themselves more or less longitudinally-arranged.

Key to discoid and allied radiate species in Australia

The species included in this key are contained within the following circumscription:
Capitula discoid, homogamous (mostly all bisexual, rarely all female), florets all tubular and ± identical in form OR
Capitula radiate; involucre < 5.5 mm long, < 3.0 mm diam.; calycular bracteoles 4–8; ligules 1–8(–9), > 2 mm long; leaves never divided or if so ligules white or pink; achenes homomorphic.

1 Capitula radiate
  2 Ligules 1–3, white or pink; plants gynodioecious (Western Australia)..... .....*S. leucoglossus*
  2: Ligules 4–9, yellow; plants hermaphrodite (eastern Australia)
    3 Plants extensively rhizomatous, aerial stems to 0.5 m high; unit inflorescences of 1–5 capitula; involucre appressed-woolly.....*S. belirianus*
    3: Plants not extensively rhizomatous, aerial stems to 2.0 m high; unit inflorescences of several to 100s of capitula; involucre glabrous

4 Leaves with l:w ratio 1.5–4; lower surface of leaves densely tomentose..... ..... ***S. garlaudii***

4: Leaves with l:w ratio > 4, or if less, the lower surface of leaves ± glabrous ..... **8. *S. linearifolius***

1: Capitula discoid

5 Annuals; calycular bracteoles conspicuously pigmented (pigment jet black in distal 2/5–4/5); phyllaries 14–23; florets > 40; corolla-limb shorter than tube (introduced species; mostly urban or cultivated environments)..... ***S. vulgaris***

5: Perennial herbs or shrubs; calycular bracteoles generally inconspicuously pigmented (pigment only ever black in distal 1/5); phyllaries 7–13; florets < 40, corolla-limb similar in length to tube

6 Shrubs, glaucous or not; always hermaphrodite; corollas of outer florets exceeding phyllaries by 2–5 mm

7 Leaves lobate to deeply pinnatisect, and if lobate, then involucre glabrous, > 5.5 mm long and phyllaries 11–13; reticulate venation pattern of leaves not or hardly discernible

8 Leaves deeply pinnatisect, axes of primary segments with l:w ratio > 8 ..... **1. *S. anethifolius***

8: Leaves lobate to subpinnatisect, axes of primary segments with l:w ratio < 8

9 Leaves fleshy, lobes/segments commonly c. oblong; phyllaries predominantly 8–10, 4.5–6 mm long (Eucla region, south-eastern Western Australia)..... **2. *S. euclaeusis***

9: Leaves not fleshy, lobes usually triangular; phyllaries predominantly 11–13, 5–8 mm long (south-central South Australia)..... ..... **3. *S. gawlerensis***

7: Leaves entire or dentate, or sometimes lobate but then involucre usually somewhat lanate, < 5.5 mm long, and phyllaries 8–10; reticulate venation of leaves clearly visible or not

10 Leaves of major branches to 15 mm wide; margin entire or if not then involucre usually lanate and/or 2–3 mm diam.; reticulate venation of leaves obscure

11 Mid-branch leaves with l:w ratio < 10, margin of most leaves of at least major branches denticulate, dentate, or lobate, margin flat or finely recurved, rarely leaves ± entire; auricles if present often bidentate; calycular bracteoles to 3 mm long, with l:w ratio mostly > 3; peduncles and capitula mostly patchily to densely woolly as flowering commences, occasionally glabrous; florets per capitulum 10–18 ..... **4. *S. lanibracteus***

11: Mid-branch leaves with l:w ratio > 7, margin of leaves of branches entire, revolute (margin of stem leaves may be dentate), auricles if present entire; calycular bracteoles to 2 mm long, with l:w ratio mostly < 2; peduncles and capitula glabrous or sometimes patchily woolly as flowering commences; florets per capitulum 8–12(–14).. ..... **5. *S. cunninghamii***

10: Leaves of major branches to 50 mm wide, commonly ± crowded-denticulate or crowded-dentate, reticulate venation clearly defined on one or both surfaces; involucre glabrous, mostly 1.5–2 mm diam.

12 Plant not glaucous; mid-branch leaves tapering strongly to a petiole-like proximal portion 1–4 cm long, auricles absent or small, lower surface ± completely obscured by indumentum .... **6. *S. hypoleucus***

12: Plant often glaucous; mid-branch leaves not tapering strongly to a petiole-like proximal portion, auricles commonly well-developed

and usually moderately stem-clasping; lower surface mostly glabrous or sparsely indumented, rarely moderately obscured by indumentum ..... 7. ***S. odoratus***

6: Non-glaucous herbaceous perennials, sometimes gynodioecious (i.e. plants hermaphrodite or female); corolla of outer florets exceeding phyllaries by 0–2 mm

13 All plants hermaphrodite: leaves undivided with margin entire, rarely lobate; involucre 2–3 mm wide (eastern Australia)

14 Leaves densely woolly on both surfaces, inflorescence branchlets, peduncles and bracts densely woolly; calycular bracteoles > 4 mm long ..... ***S. helichrysoides***

14: Leaves densely appressed woolly on lower surface only, inflorescence branchlets, peduncles and bracts sparsely woolly; calycular bracteoles < 4 mm long ..... ***S. georgianus***

13: Plants hermaphrodite or female; leaves pinnatisect or undivided and then crowded-dentate; involucre 1.5–2 mm wide (Western Australia)

15 Leaves undivided with margin crowded-dentate, glabrous; inflorescence narrow-pyramidal (lateral capitula/clusters not reaching to medial capitulum/cluster) ..... ***S. ramosissimus***

15: Leaves pinnatisect, lower surface appressed-woolly; inflorescence not pyramidal (lateral capitula/clusters equal to or overtopping medial capitulum/cluster) ..... ***S. gilbertii***

Part 1. Taxonomy of the Australian shrubby, discoid *Senecio*

Shrubs or subshrubs, often glaucous, nearly glabrous or with hairs on peduncles, capitula and leaves, particularly the lower surface. *Leaves* undivided or less often lobate or pinnatisect; margin dentate, serrate or entire. *Unit inflorescences* commonly corymbiform, of c. 10–80 somewhat congested capitula; peduncles finally 10–15 mm long. *Capitula* discoid; calycular bracteoles 3–6, ovate to narrow-lanceolate or linear, 1.0–6.0 mm long, 0.3–1.0 mm wide, with resin ducts commonly prominent; involucre ± cylindrical, 3–8 mm long, 1.5–3.0 mm diam.; phyllaries 7–13, free; stereome flat or convex, often firm, often drying yellow, glabrous or with an appressed wool, with resin ducts 1 or 2, often orange or red; outer phyllaries with a vestigial scarious margin. *Florets* 7–25; corolla-limb equal to or slightly longer than tube. *Achenes* homomorphic, narrow-obloid, 1.6–4 mm long, ribs ± flat, moderately papillose-hairy, with l:w ratio ratio of hairs c. 3–5, diam. of annulus c. 1/3–1/2 of diam. of achene. *Pappus* caducous; bristles nearly smooth or minutely scabrid-barbellate.

1. *Senecio anethifolius* A.Cunn. ex DC., *Prodr.* 6: 371 (1838)

Type: [New South Wales], 'in Nova-Hollandia interiori in collibus rupestris prope Peel's Range Anglorum' [Cocoparra Range], *A. Cunningham*; holo: G *n.v.* (microfiche seen MEL).

Shrubs to 2.0 m high, glabrous or sometimes transiently hairy on new growth, glaucous or not. *Leaves* slightly fleshy; mid-stem/mid-branch leaves to 13 cm long, with l:w ratio c. 1.5–3, deeply pinnatisect, c. orbicular, ovate or elliptic in outline; primary axis linear to narrow-linear; major divisions 2–6 per side, linear to filamentous, to 6 cm long, 0.3–2.5 mm wide (dry), sometimes again divided; base attenuate or sometimes with small undivided lobes; margin entire; reticulate venation obscure. *Unit inflorescences* typically of c. 20–80 capitula. *Capitula*: calycular bracteoles 2–6, 0.5–5.0 mm long; involucre 3.5–8.0 mm long, 2.0–2.5(–3.0) mm diam.; phyllaries 7–9; stereome mostly convex, with resin ducts variously developed, pale, orange or red; inner phyllaries most often with a single duct. *Florets* 7–15; corolla 5–8 mm long, with lobes 0.5–1.5 mm long. *Achenes*

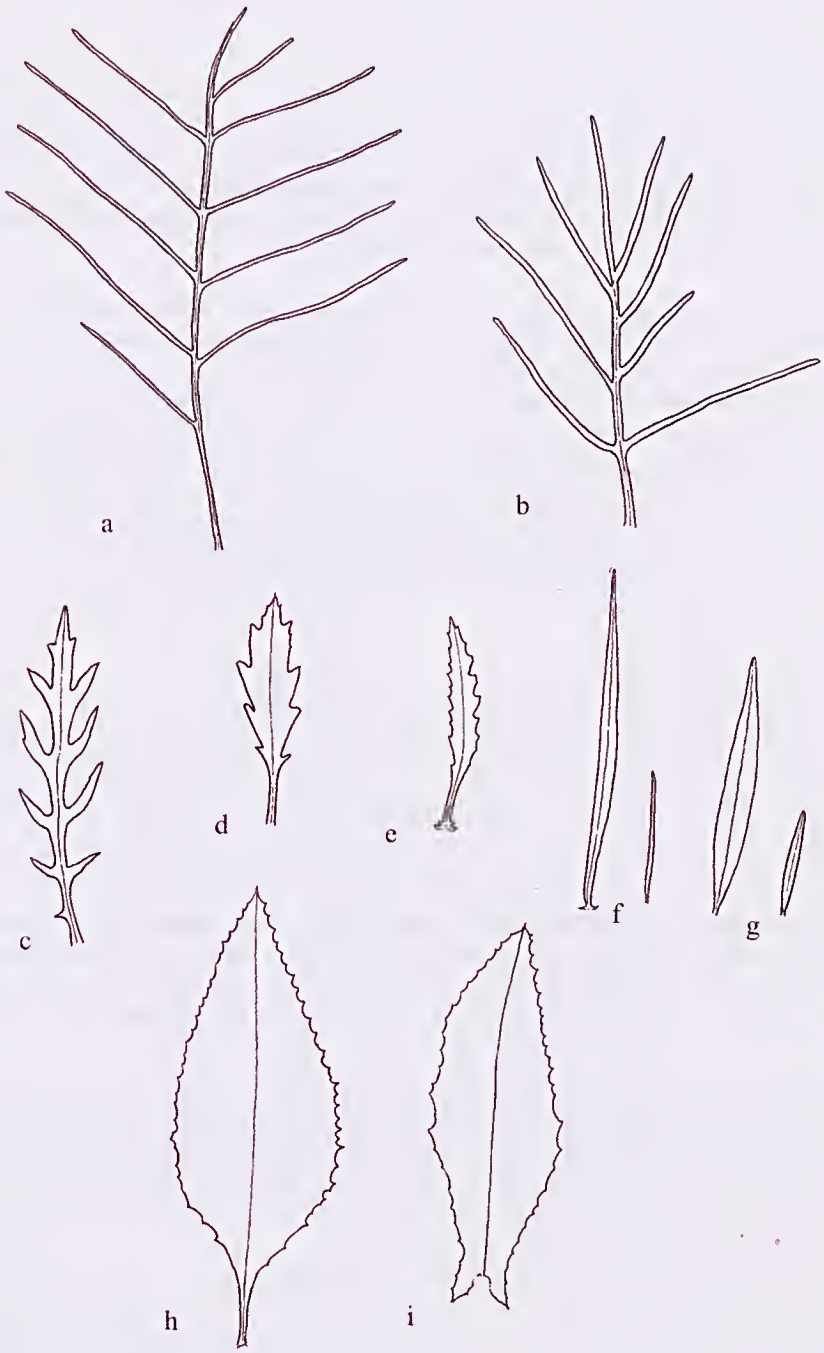

Figure 1. Typical leaves of the shrubby, discoid species. a. *S. anethifolius* subsp. *anethifolius*; b. *S. anethifolius* subsp. *brevibracteolatus*; c. *S. enclaensis*; d. *S. gawlerensis*; e. *S. lanibracteus*; f. *S. cunninghamii* var. *cunninghamii*; g. *S. cunninghamii* var. *flindersensis*; h. *S. hypoleucus*; i. *S. odoratus*.

narrow-obloid, 2.0–3.0 mm long, pale to dark brown, with papillose hairs in bands a few hairs wide, with l:w ratio of hairs c. 3. *Pappus* 3.5–5.0 mm long.

Flowers mostly winter to summer.

Distribution and Habitat: Occurs in south-eastern Australia from the Flinders Ranges in south-eastern South Australia east to central New South Wales. Grows among rocks and/or in sand, sometimes in or beside watercourses, in open woodland and shrubland.

Notes: There are two subspecies. Putative hybrids between *S. lautibracteus* I.Thomps. and one or both of the subspecies have been recorded at several places in South Australia and near Broken Hill in western New South Wales.

1 Plants not glaucous, or rarely slightly glaucous; segments of leaves very fine (of major branches mostly 0.8–2.0 mm wide; of secondary branches mostly 0.3–0.8 mm wide (dried)); calyeular bracteoles (1.5–)2.0–5.0 mm long; involuere 5.0–8.5 mm long, with resin ducts of phyllaries and bracteoles fine, not raised; corolla lobes mostly 1.0–1.6 mm long (dried) ..... **1a.** subsp. ***anethifolius***

1: Plants glaucous at least on newer growth; segments of leaves generally broader than above (of major branches mostly 1.5–3.5 mm wide, of secondary branches mostly 0.6–1.5 mm wide (dried)); calycular bracteoles 0.5–2.0 mm long; involuere 3.5–6.0(–7.0) mm long, with resin duets of phyllaries and bracteoles eommonly broad and often raised; eorolla lobes mostly 0.6–1.0 mm long (dried) .... **1b.** subsp. ***brevibracteolatus***

1a. ***Senecio anethifolius*** A.Cunn. ex DC. subsp. ***anethifolius***

Senecio angustilobus F.Muell., *Linnaea* 25: 418 (1853); *Senecio augustifolius* Sond., *Linnaea* 25: 526 (1853) [An error by Sonder who was intending to present Mueller's *S. angustilobus*].

Type: South Australia, 'In cacuminibus montium petraeorum Cudnaka versus' [Kanyaka, Flinders Ranges], *F. Mueller*, Oct 1847; leeto (**here selected**): MEL 275094; isolecto: MEL.

Plants not glaueous, or rarely slightly glaueous. *Leaves*: segments 3–6 per side, 0.3–2.0 mm wide (dried). *Peduncles* at anthesis mostly 2–6 mm long. *Capitula*: calyeular bracteoles (1.5–)2.0–5.0 mm long; involucre 5.0–8.5 mm long; phyllaries often not black-tipped, with resin duets usually narrow, not raised, orange. *Florets* 7–12; eorolla-lobes mostly 1.0–1.6 mm long (dried). (Figs 1a, 3)

Distribution: Oecurs in south-eastern Australia from the Flinders Ranges in south-eastern South Australia south-east to Robertstown in South Australia and east to Broken Hill in far western New South Wales, and disjunetly further east in central New South Wales where it occurs from the Merrimerriwa Range south to the Narrandera district (Fig. 2a).

Notes: This subspecies is sympatric with and possibly hybridises with subsp. *brevibracteolatus* in the Southern Flinders Ranges.

Selected specimens examined: **SOUTH AUSTRALIA**: Southern Flinders Ranges. Yourambulla Caves area, c. 10 km SW of Hawker, *R.V. Smith 89/29*, 16.ix.1989 (AD, MEL); ca. 16 km west of Gordon, *H.M. Cooper*, 20.ix.1969 (AD); Bumbumbii Springs. Koonamore, *T.B. Paltridge 7*, 21.ix.1928 (AD); 'Dome Rock', 30 miles [48 km] W of Mingary, *A.G. Spooner 3771*, 16.xi.1974 (AD); S slope of Warren Gorge, 21 km N of Quorn, Flinders Ranges, *A. Sikkes AS641*, 21.ix.1973 (AD, CBG). **NEW SOUTH WALES**: 42 km from central Broken Hill on road to Mt Robe, roadside, *R.B. Hadlow 86 & A.B. Court*, 8.x.1981 (CBG, NSW); Cocopara National Park, Woolshed Creek area, *J.W. Wrigley*, 4.x.1971 (CBG); Euriowie Creek, 55 miles [90 km] S of Packsaddle, *C.R. Dunlop CD1384*, 29.viii.1969 (CBG); 'Yathong' Station, N of Hillston, *W.E. Mulham W615*, Oct. 1972 (CANB).

Figure 2. Distribution of a. *S. anethifolius* subsp. *anethifolius*; b. *S. anethifolius* subsp. *brevibracteolatus*; c. *S. euclaensis*; d. *S. gawlerensis*.

1b. *Senecio anethifolius* subsp. ***brevibracteolatus*** I.Thomps., *subsp. nov.*

A subspeeie typiea paginis glaueis, segmentis foliorum latioribus paueioribus, pedunculis longioribus, bracteolis brevioribus, eapitulis brevioribus pluribus, eorollis minoribus differt.

Type: South Australia, in Buekaringa Gorge, *L. Haegi 3480 & B.R. Moore*, 12 Dec. 1985; holo: AD; iso: BRI, CBG, MEL.

Plants glaueous, sometimes only slightly on stems, leaves, peduneles, and eapitula. *Leaves*: segments 2–4 per side, 0.6–3.5 mm wide (dried). *Peduncles* at anthesis mostly 3–10 mm long. *Capitula*: ealycular bracteoles 0.5–2.0 mm long; involuere 3.5–6.0(–7.0) mm long, phyllaries often black-tipped, with resin duets usually broad, raised, orange, red or blackish-red. *Florets* 10–15; corolla-lobes 0.6–1.0 mm long (dried). (Figs 1b & 4)

Distribution: Occurs in eentral-eastern South Australia from Mt Livingston in the Gammon Ranges south to the Flinders Ranges and also slightly further south-east at Mt Bryan (Fig. 2b).

Etymology: The epithet alludes to the short braeteoles of this subspecies (L. *brevis*, short and *bracteolatus*, braeteolate).

Selected specimens examined: **SOUTH AUSTRALIA**: Horrocks Pass, 9.5 km from Wilmington towards Port Augusta, *R.J. Bayer SA-99021 & G.T. Chandler*, 27.x.1999 (AD, CANB); Slopes of Mt Brown Creek on E slopes of Mt Brown, *D.E. Symon 8530*, 24.iv.1973 (AD, CANB); Waterfall Creek, Baroota Reservoir, *R. Filson 3170*, 18.ix.1960 (MEL); Flinders Range – Entrance Wilpena Pound (about 30 miles [48 km] N of Hawker), *R. Hill*, 25.x.1955 (AD); 5 km S of Leigh

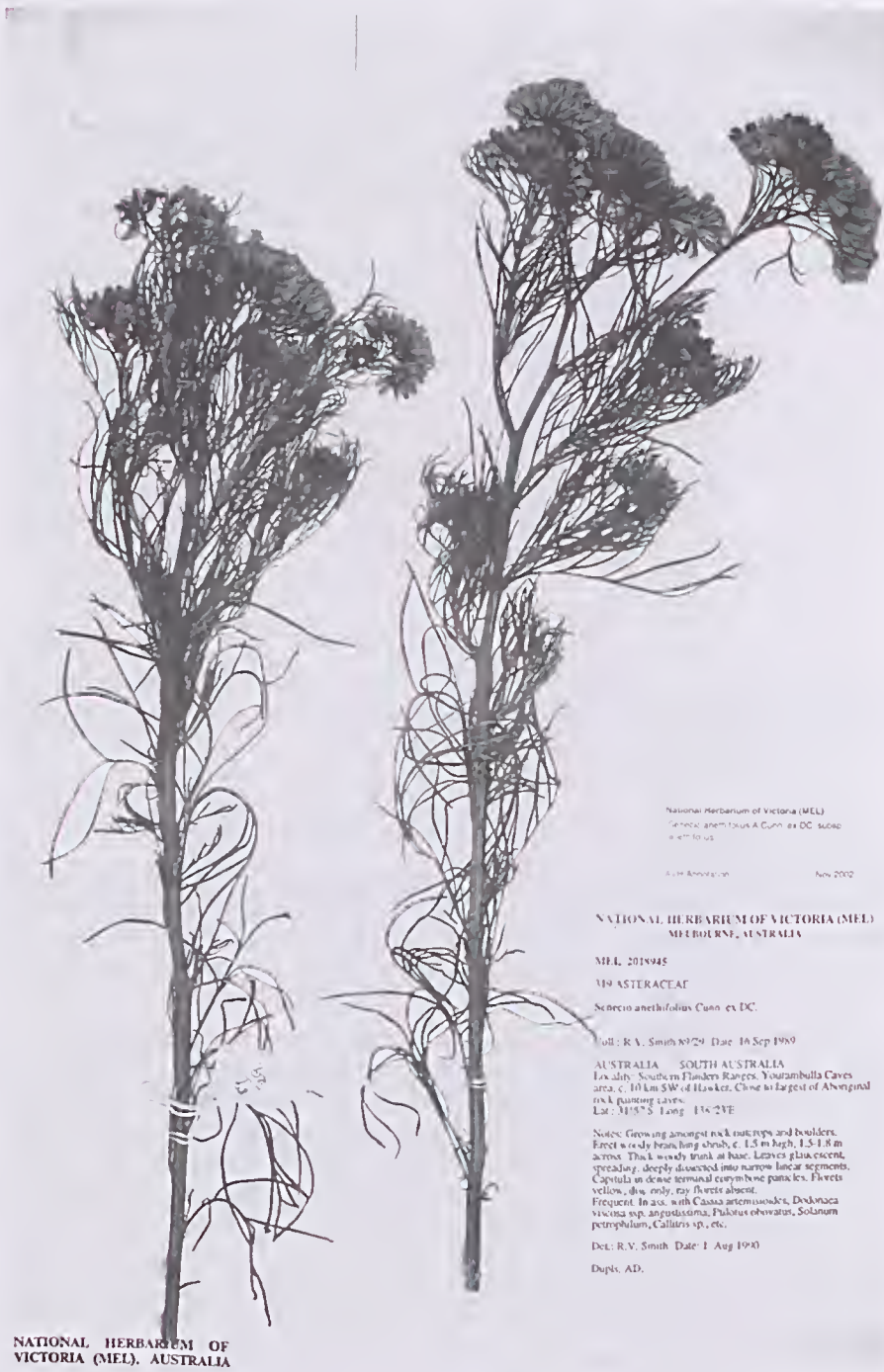
National Herbarium of Victoria (MEL)
Nov 2002
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2018945
339 ASTERACEAE
Senecio anethifolius Cunn. ex DC.
Coll: R.V. Smith 89/29 Date: 16 Sep 1989
AUSTRALIA SOUTH AUSTRALIA
Locality: Southern Flinders Ranges. Yourambulla Caves area, c. 10 km SW of Hawker. Close to largest of Aboriginal rock painting caves.
Lat: 31°57'S Long: 138°2'E
Notes: Growing amongst rock outcrops and boulders. Erect woody branching shrub, c. 1.5 m high, 1.5-1.8 m across. Thick woody trunk at base. Leaves glaucescent, spreading, deeply dissected into narrow linear segments. Capitula in dense terminal corymbose panicles. Florets yellow, disc only, ray florets absent.
Frequent. In ass. with Cassia artemisioides, Dodonaea viscosa ssp. angustissima, Pultenaea obovata, Solanum petrophilum, Callitris sp., etc.
Det: R.V. Smith Date: 1 Aug 1990
Dupls. AD.
NATIONAL HERBARIUM OF VICTORIA (MEL). AUSTRALIA

Figure 3. *S. anethifolius* subsp. *anethifolius* (*R.V. Smith 89/29* MEL).

AD98934111
AD98934111
15.11.99
Senecio anethifolius Cunn. ex DC
Det A.A.Munir 1999
STATE HERBARIUM OF SOUTH AUSTRALIA
ADELAIDE (AD)
Senecio anethifolius Cunn. ex DC.
South Australia. Region 5: Flinders Ranges
32°07'S 138°02'E
In Puckaringa Gorge. In rocky scree among vertical rock outcrops on southern side, in heart of gorge, c. 50m above creek, opposite windmill and tank.
Soft-wooded shrub with aromatic fleshy foliage, c. 1m tall and diam. Stems reddish, flowers yellow.
Occasional in boulder scree and on rock outcrops.
Cuttings collected for Dot Glen, Adelaide
L.Haegi 3480 & B.R.Moore
12.vii.1985
Duplicates sent to: BRI, CBG, MEL, CC
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio anethifolius DC.
subsp. brevibracteolatus I.Thomps.
Det Ian Thompson Date 19. v. 2007
L. HAEGI 3480
4/02
407

Figure 4. *S. anethifolius* subsp. *brevibracteolatus* (holotype: *L. Haegi 3480 & B.R. Moore* AD).

Western Australian Herbarium
PERTH 00812234
WESTERN AUSTRALIAN HERBARIUM
PERTH, W.A.
WILDLIFE RESEARCH CENTRE
Name Senecio
Habit Spreading erect salt shrub
Height 20/140cm x 30/90 cm
Flower Colour yellow
Abundance very common
Associated Veg. Senecio dominated shrubland
Topography valleys along cliff
Soil – surface grey sandy clay
– subsurface limestone
Locality 2 km. west of W.A./S.A. Border; Eucla National
Collector G.J. Keighery and J.J. Alford No. 906
DATE 12/10/1986 lat long
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio euclaensis I.Thomps.
Det Ian Thompson Date 15 x 2003

Figure 5. *S. euclaensis* (holotype: *G.J. Keighery 906 & J.J. Alford* PERTH).

Creek township, *D.N. Kraehenbuehl 7312*, 20.ix.1993 (AD); Dutchman's Stern Range, 3 km W of Quorn, *F. Mollemans 1205*, 10.x.1981 (AD); In Bolla Bollana Creek, *V.J. Levitzke 0507*, 28.xi.1980 (AD); Near the summit of Mt Bryan, *D.N. Kraehenbuehl 7280*, May 1988 (AD, CANB).

2. *Senecio euclaensis* I.Thomps., *sp. nov.*

A *S. gawlerensis* M.E.Lawr. foliis carnosis segmentis plerumque oblongis, bracteolis brevioribus, phyllariis paucioribus brevioribus differt.

Type: Western Australia, 2 km west of Western Australia/South Australia border; Eucla National [Park], *G.J. Keighery & J.J. Alford 906*, 12 Oct. 1986 (PERTH).

Shrubs to 1.5 m high, glabrous, or sometimes sparsely and transiently cobwebby, not glaucous. *Leaves* fleshy; mid-stem/mid-branch leaves narrow-elliptic or oblanceolate, to 10 cm long, with l:w ratio c. 2.5–4, deeply lobate to subpinnatisect; major divisions 2–5 per side, strongly antrorse, triangular, oblong, narrow-oblong or obovate; base attenuate, petiole-like; margin ± entire or few-denticulate or dentate, revolute; surfaces ± glabrous; reticulate venation inconspicuous. *Unit inflorescences* of c. 60 capitula. *Capitula*: calycular bracteoles 4–6, 1.5–2.5 mm long; involucre 4.5–6.0 mm long, 3.0–3.5 mm diam.; phyllaries predominantly 8–10, a small percentage with 11–13, glabrous or cobwebby; stereome ± flat, with resin ducts broad, reddish; inner phyllaries most often with 2 ducts. *Florets* 15–25; corolla c. 6 mm long, with lobes c. 1 mm long. *Achenes* not known at maturity, immature achenes with papillose hairs. *Pappus* c. 4–5 mm long. (Figs 1c, 5)

Flowers spring.

Distribution: Occurs in the Eucla area, including Eucla National Park, in the far south-east of Western Australia (Fig. 2c).

Etymology: The epithet alludes to the distribution of this species.

Notes: Known only from two collections near Eucla. Similar to *S. gawlerensis* but differs in having fleshy leaves with major divisions more deeply dissected and generally more oblong or obovate rather than triangular, shorter calycular bracteoles and involucres with fewer, less convex, and at first slightly cobwebby phyllaries.

Selected specimens examined: **WESTERN AUSTRALIA**: Eucla, *Carey*, 1877 (MEL).

3. *Senecio gawlerensis* M.E.Lawr., *J. Adelaide Bot. Gard.* 7: 292 (1985)

Senecio georgianus DC. var. *latifolius* J.M.Black, *Fl. S. Australia* 613 (1929).

Type: [South Australia], 10 miles [16 km] W. Yardea, E.P. [Eyre Peninsula], *J.B. Cleland*, 24 Aug. 1928; lecto: AD, *fide* M.E.Lawrence, *loc. cit.*

Shrubs to 1.5 m high, glabrous, or sometimes sparsely and transiently cobwebby, not glaucous. *Leaves* hardly fleshy; mid-stem/mid-branch leaves lanceolate, elliptic to narrow-elliptic, or oblanceolate, to 12 cm long, with l:w ratio c. 2–3, coarse-dentate to subpinnatisect; major divisions several per side, strongly antrorse, triangular; base attenuate, petiole like; margin ± entire or few-denticulate or dentate. *Unit inflorescences* typically of c. 20–80 capitula. *Capitula*: calycular bracteoles 4–8, 2.0–4.5 mm long, often somewhat spreading; involucre (5.5–)6.0–8.0 mm long, c. 3.0 mm diam.; phyllaries 11–14, glabrous; stereomes convex, with resin ducts fine, reddish; inner phyllaries most often with a single duct. *Florets* 15–25; corolla 6–7 mm long, with lobes 0.6–0.8 mm long. *Achenes* narrow-obloid, 2.0–3.0 mm long, brown, with papillose hairs forming bands several hairs wide, with l:w ratio of hairs c. 4. *Pappus* c. 6 mm long. (Fig. 1d, 6)

Flowers mostly late winter–spring.

Distribution and Habitat: Occurs in south-central South Australia from Hiltaba east to Quorn in the Flinders Ranges and south-south-east to Corunna Hill on the Eyre Peninsula (Fig. 2d). Grows commonly among rocks on hillsides, also on sandy flats beside creeks, in open woodland and shrubland

Selected *specimens examined:* **SOUTH AUSTRALIA**: Miceollo Hill, 68 km NW (by road) from Iron Knob, Gawler Ranges, *B.J. Conn 1816*, 28.viii.1985 (AD, MEL, NSW); Gawler Ranges, E slope of Mt Gairdner, *P. Price*, 3.x.1972 (AD, CANB); Lower Flinders Ranges, Hancock's Lookout, ca. 42 km south-east of Port Augusta, near Wilmington, *coll. unknown* (Adelaide Botanical Garden collection), 2.x.1960 (AD).

4. ***Senecio lanibracteus*** l.Thomps., *nom. and stat. nov.*

Senecio cunninghamii DC. var. *serratus* M.E.Lawr., *J. Adelaide Bot. Gard.* 7: 291 (1985).

Type: [South Australia], S. Aust., Chintapanna Dam, Witchelina Station, *F. Badman 182*, 13 Mar. 1979; holo: AD; iso: HO.

Shrubs to 1.8 m high, typically with a close, short wool usually present on younger parts, variably dense and persistent, rarely ± glabrous, sometimes mildly glaucous. *Leaves* subfleshy to coriaceous; mid-branch leaves narrow to very narrow-elliptic, to 10 cm long, with l:w ratio 2–11, undivided or coarse-dentate to lobate; major divisions 3–7(–12) per side, antrorse, mostly triangular, rarely e. oblong, with l:w ratio 1–2; base attenuate or auriculate, with auricles entire or bilobed, hardly amplexicaul; margin dentate or denticulate, with teeth often frequent, rarely entire; both surfaces often appressed-woolly at least when young, variably glabrescent, sometimes glabrous; reticulate venation obscure. *Unit inflorescences* of c. 5–40 capitula; peduncles commonly somewhat woolly at anthesis. *Capitula*: calycular bracteoles 2–6, mostly lanceolate, 1.2–3.0 mm long; involucre 3.0–6.0 mm long, 2.0–3.0 mm diam.; phyllaries 8–10(–12), slightly to densely appressed-woolly, variably glabrescent, rarely glabrous; stereome flat to slightly convex, with resin ducts moderately broad, pale or orangish; inner phyllaries with 1 or 2 ducts. *Florets* 10–18(–22); corolla 5–6 mm long, with lobes 0.6–0.8 mm long. *Achenes* narrow-obloid, 2.5–4.0 mm long, straw-coloured, with papillose hairs usually in bands several hairs wide, with l:w ratio of hairs c. 5. *Pappus* 4–7 mm long. (Figs 1e, 8)

Flowers most of year, probably dependent on moisture.

Distribution and Habitat: Occurs in central to central-eastern Australia from the George Gill Ranges in southern Northern Territory south-east to Pooncarie in far south-western New South Wales and east to Birdsville in far south-western Queensland. Also a single record further south from Lake Brambruk in north-western Victoria. There are also a few very old records from the Geraldton area in far western Western Australia (Fig. 7a). Grows commonly in or near drains or watercourses in plains, on various soils, often saline, in shrubland and woodland.

Etymology: The epithet alludes to the indumentum covering the phyllaries (L. *lanus*, wool and *bracteus*, bract).

Notes: Previously treated as a variety of *S. cunninghamii*, although it is not clear from this study that this species is its closest relative. Elevating the rank of this taxon necessitates the creation of a new epithet because the name *Senecio serratus* has already been taken. *Senecio lanibracteus* differs from *S. cunninghamii* in leaf shape and dentition and, usually, in the presence of indumentum on phyllaries, leaves and new growth, in the length and shape of calycular bracteoles, and in the number of florets per capitulum. Phyllaries of *S. lanibracteus* are ± rigid and narrow-ovate or narrow-elliptic whereas those of *S. cunninghamii* are more flexible and are closer to narrow-oblong. A glabrous

Figure 6. *S. gawlerensis* (*S.A. N.P.W.S. Gawler Ranges Survey 7549* MEL).

Figure 7. Distribution of a. *S. lanibracteus*; b. *S. cunninghamii* var. *cunninghamii*; c. *S. cunninghamii* var. *flindersensis*; d. *S. hypoleucus*; e. *S. odoratus*.

form of this species occurs in far north-eastern South Australia and far south-western Queensland. In other respects it is typical of the species. At Dalhousie Springs in northern South Australia (e.g. *D.E. Symon 14462*, AD, CANB) plants differ from typical *S. lanibracteus* in having larger capitula with 12 phyllaries. These two variants warrant further investigation. Specimens from Macquarie Marshes in central New South Wales are intermediate in form between *S. lanibracteus* and *S. cunninghamii*. Hybridisation between these two species is a possible explanation but there are no records of typical examples of these species from this locality.

Selected specimens examined: **NORTHERN TERRITORY**: ca. 2.5 km E on Col. Rose Drive; Sth Stuart Hwy; ca. 7.5 km SE Heavitree Gap, *D.E. Albrecht 5761*, 8.ii.1994 (AD, DNA, MEL, NT); East side, Alice Springs, *P.K. Latz 1015*, 21.xii.1970 (DNA). **SOUTH AUSTRALIA**: Lake Eyre Basin, Coongie Lake, *P.E. Conrick 2263*, 5.vi.1987 (AD, MEL); 8 m [13 km] NE of Marree on Birdsville Track, *A.C. Beauglehole 28136*, 1.viii.1968 (AD, MEL); 26 km N of Copley on road to Lyndhurst, *I.C. Clarke 3002*, *J. Vaganiance*, *W. Hyke & O. Sherlock*, 25.x.1999 (MEL); Lake Eyre, Joe's dam, Millers Creek Station, *F.J. Badman 7569*, 14.iv.1995 (AD, MEL). **QUEENSLAND**: Mulligans River, *A. Henry*, 1889 (MEL). **NEW SOUTH WALES**: Mootwingee National Park, Homestead Gorge, 112 km NE of Broken Hill, *I. Crawford 1062*, 23.x.1988 (CBG, NSW, PERTH); Opera Tank, Channel Paddock, Lake Mere Station, *T.R. Lally 268*, 24.iii.1994 (CANB, MEL); 40 km N of Tibooburra on Wittabrenna Creek floodplain, Sturt National Park, *P.E. Conrick 642*, 5.ix.1981 (AD, MEL); Menindee Lakes, near the road at the S end of Lake Pamamaroo and about 2 km SW of the outlet regulator, *J.H. Browne 309*, 3.x.1985 (MEL); 2 km SE of Carruranna WH. Cooper Creek, *F.J. Badman 1566.*, 24.ii.1984 (AD, CBG). **VICTORIA**: Wyperfeld National Park, south west side of Lake Brambruk, 3.5 km north of Wonga Hut, *A.C. Beauglehole 57048* & *E. Harberger*, 14.xi.1977 (MEL).

5. *Senecio cunninghamii* DC., *Prodr.* 6: 371 (1838), as *Cunninghami*.

Type: [New South Wales], 'In Nova-Hollandia verisim. ad lacum Georgii' [Lake George], *A. Cunningham*; holo: G *n.v.* (microfiche seen at MEL)

Shrubs to 1.8 m high, ± glabrous except for transiently woolly newer growth, sometimes glaucous especially on younger growth. *Leaves* sub-fleshy to fleshy; mid-branch leaves narrow-elliptic, narrow oblong-elliptic or linear to narrow-linear, to 14 cm long, with l:w ratio c. 7–40, undivided (stem leaves sometimes dentate); base attenuate or upper leaves with small undivided auricles, not amplexicaul; margin entire, revolute, or sometimes larger leaves with scattered teeth; reticulate venation not conspicuous. *Unit inflorescences* of c. 5–25 capitula. *Capitula*: calycular bracteoles 1–4, 0.7–1.5(–2.0) mm long; involucre 3.0–5.0 mm long, c. 1.5–2.0 mm diam.; phyllaries (6–)7–9, slightly convex, patchily woolly at or prior to anthesis or glabrous, and then often glaucous; stereome mostly convex, with resin ducts fine or well-developed, pale or orangish; inner phyllaries usually with 1 duct. *Florets* 8–12(–14); corolla 4–6 mm long, with lobes 0.6–0.8 mm long. *Achenes* narrow-obloid, 2–4 mm long, olive-brown, with papillose hairs in bands 2 or 3 hairs wide or hairs somewhat dispersed, with l:w ratio of hairs c. 5. *Pappus* 4–6 mm long.

Flowers mostly summer–autumn.

Distribution and Habitat: Occurs in south-eastern South Australia, south-central New South Wales and western to central Victoria, with outlying populations in north-central New South Wales. There is one old record (MEL 2167322) labelled Darling Downs (South-eastern Queensland), *W. Hill*, which is likely to have been mislabelled. Grows in various soils commonly associated with watercourses or in drains or depressions in shrubland, woodland and forest.

There are two varieties.

1 Length:width ratio of mid-branch leaves (of longer branches) 15–40; peduncles and capitula glabrous, often glaucous at and before anthesis.....**5a.** var. ***cunninghamii***

1: Length:width ratio of mid-branch leaves (of longer branches) 7–15(–20); peduncles and capitula patchily woolly before anthesis, lost or persistent at anthesis, not glaucous .....**5b.** var. ***flindersensis***

5a. *Senecio cunninghamii* DC. var. ***cunninghamii***

Senecio brachylaenus DC., *Prodr.* 6: 370 (1838). Type: [New South Wales], 'In Nova-Hollandia interiore ad ripas flum. Lachlan' [Banks of the Lachlan River], *A. Cunningham 142*, June 1817; holo: G *n.v.* (microfiche seen at MEL).

Stem leaves with l:w ratio > 10; margin usually entire; mid-branch leaves with l:w ratio 15–40. *Peduncles and capitula* glabrous at and before anthesis, often glaucous. (Figs 1f, 9)

Distribution: Occurs in south-eastern Australia from the Fleurieu Peninsula in south-eastern South Australia east to Hay in south-central New South Wales and south-east to the western outskirts of Melbourne in south-central Victoria. Also occurs disjunctly in the Macquarie Marshes area in north-central New South Wales (Fig. 7b).

Selected specimens examined: **SOUTH AUSTRALIA**: Yorke Peninsula. Ca. 3 km east of Port Victoria, *J.B. Cleland*, 17.iii.1959 (AD, CANB); 7 km N of Renmark, Wookual Bend on River Murray, *M.E. Lawrence 778*, 4.vi.1977 (AD); Lake Alexandrina, south-east margin, ca. 90 km south-east of Adelaide. *P. Wilson 1414*, 22.xi.1959 (AD). **NEW SOUTH WALES**: 30 miles [48 km] N of Hay, *W.E. Mulham S37*, 26.ix.1963 (CANB); North side of the Lachlan River bridge, Oxley, *R.G. Coveny 18692, G. Chapple, P.G. Kodela, & H. McPherson*, 4.x.2000 (AD, BRI, MEL, NSW). **VICTORIA**: north of Benjeroop State Forest, *A.C. Beauglehole 83197*, 29.xii.1985 (AD, CANB); Koondrook. Top of steep Murray R. banks just E of junction with Gunbower Creek, *J.H. Willis*, 21.iii.1972 (MEL); Jilpanger Flora and Fauna Reserve, c. 50 km SW of Horsham, *D. Cook*

National Herbarium of Victoria (MEL)
Senecio lanibracteus I Thomps ms
AVH Annotation
Nov 2002
MEL 1594153
FLORA OF AUSTRALIA
Senecio cunninghamii DC.
South Australia: Flinders Ranges. Copley, at junction to Arkaroola.
Gravelly ground
Suffrutex, c. 1 m. Foliage bluish green, glaucous. Capitula discoid, with 8 bracts. Fls yellow.
2. XI. 1989
Leg. B. Nordenstam & A. Anderberg No. 982
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Figure 8. *S. lanibracteus* (*B. Nordenstam & A. Anderberg 982* MEL).

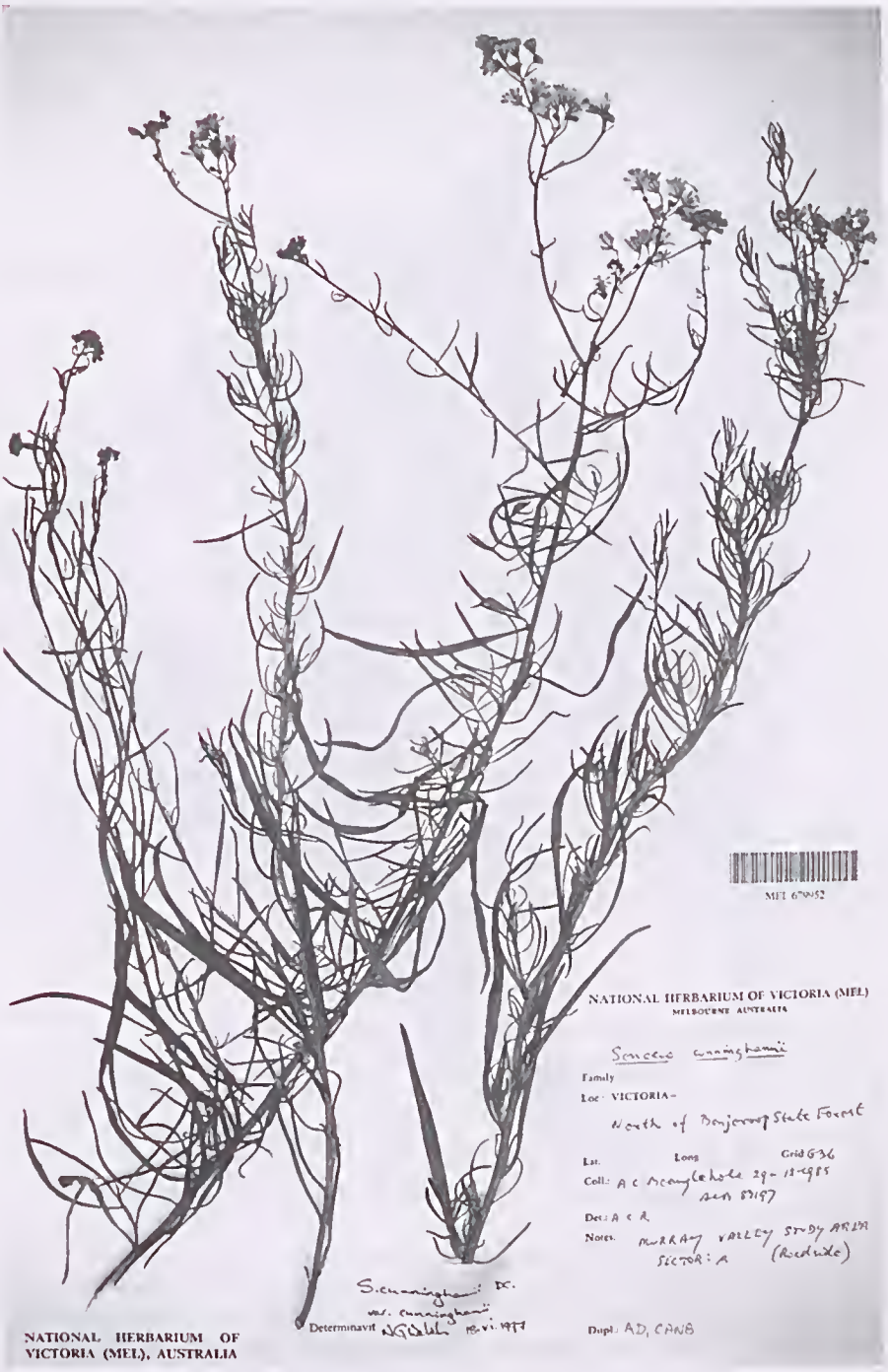

Figure 9. *S. cunninghamii* var. *cunninghamii* (*A.C. Beauglehole 83197* MEL).

s.n., Sept. 1991 (MEL); Diggers Rest, *P.R.H. St.John*, 25.iii.1901 (MEL); Bannockburn [NW of Geelong]. Rail reserve (W side) 2 km N of Bannockburn station, on railway side of fence line, *K. McDougall s.n.*, 25.iv.1992 (MEL); Mullaroo creek, Lindsay Island, 12 m. [19 km] N of Sturt Highway, ± 54 m. [88 km] W of Mildura PO, *A.C. Beauglehole 40614*, 20.x.1972 (AD, MEL); Ballarat–Clunes road, 2 km south of Clunes, *R. Thomas*, 2.viii.1990 (MEL); 19 km W of Goroke PO, 84 km W of Horsham PO, *A.C. Beauglehole 66844*, 29.xi.1979 (AD, MEL, NSW); Boort-Durham Ox Rd. c. 1 km W of Durham Ox, between Serpentine and Flume Creeks, N side of Rd, *A.C. Cochrane 549 & N.G. Walsh*, 2.iii.1999 (AD).

5b. *Senecio cunninghamii* DC. var. ***flindersensis*** I.Thomps., *var. nov.*

A varietate typica, foliis 7–15(–20)plo longioribus quam latioribus, pedunculis et capitulis non glaucus, paulo lanatibus differt.

Type: South Australia, Lower Flinders Range, Melrose (Melrose is ca. 60 km south-east of Port Augusta), *H. Antsberg*, 20 Aug. 1972; holo: AD.

Stem leaves with l:w ratio < 10; margin often dentate; mid-branch leaves with a l:w ratio of 7–15(–20). *Peduncles and capitula* mostly patchily woolly at and before anthesis, not glaucous. (Figs 1g, 10)

Distribution: Occurs in south-eastern South Australia from near Hawker in the Flinders Ranges south-south-east to Clare (Fig. 7e).

Etymology: The epithet alludes to the Flinders Ranges where this variety occurs.

Notes: This variety was alluded to by Lawrence (1985b) when she noted the existence of specimens intermediate in morphology between *S. lanibracteus* (as *S. cunninghamii* var. *serratus*) and typical *S. cunninghamii*. The affinity of these specimens is clearly with *S. cunninghamii* but they resemble *S. lanibracteus* in developing some wool on their capitula.

Selected specimens examined: **SOUTH AUSTRALIA**: Port Augusta, *T.S. Lea*, 25.i.1886 (AD); near Wonaka, *R.J. Bates 37424*, 29.iv.1994 (AD, CANB, MEL); Morehard, *R.J. Bates 9383*, 28.ii.1987 (AD); Ca. 5 km south of Kanyaka at roadside, *W.R. Barker 312*, 4.iii.1968 (AD); Quorn, 2 miles (3.22 km) West, *H.M. Cooper*, Mar. 1941 (AD); Peterborough, *L.D. Williams 2776*, 10.iv.1966 (AD); Between Hammond and Amyton, *R. Bates 14312*, 17.v.1988 (AD); North of Terowie, *R. Bates 9443*, 1.ii.1987 (AD); 42 km ex Yunta, road from Oodla Wirra, *G. Leske 60*, 17.iii.1997 (AD).

6. *Senecio hypoleucus* F.Muell. ex Benth., *Fl. Austral.* 3: 672 (1867)

Type: [Victoria], Wimmera, *Dallachy*; ?syn: K *n.v.*, MEL; [South Australia], Mount Lofty, *Wilhelmi*; syn: K *n.v.*; [South Australia], Mount Lofty, *Whittaker*; syn: K *n.v.*

Senecio odoratus Hornem. var. *petiolata* Sond., *Linnaea* 25: 526 (1853), as ß *petiolata*. Type: [South Australia], 'Ad fluv. Torrens [River Torrens], 1849, *F. Mueller*; syn: MEL; [South Australia], in tractu montium Bugle-range [Bugle Range], *F. Mueller*, 23 Nov. 1848; syn: MEL

Shrubs to 1.5 m high, with hairs on leaves and stems, not glaucous. *Leaves* not fleshy; mid-stem/mid-branch leaves to 14 cm long, with l:w ratio c. 2–6, proximal 1–4 cm petiole-like, blade portion elliptic to narrow-elliptic, or lanceolate, undivided; base attenuate; margin dentate or denticulate, with teeth frequent; upper surface sparsely appressed-cobwebby, denser along midrib, glabrescent, reticulate venation impressed; lower surface moderately to densely appressed-woolly, with hairs entirely wispy or coarse at base; secondary and sometimes reticulate venation usually distinct. *Unit inflorescences* typically of c. 20–80 capitula. *Capitula*: calycular bracteoles 3–6, 1.5–2.0 mm long; involucre 4.0–6.0 mm long, c. 1.5–2.0 mm diam., glabrous; phyllaries 7–10; stereome convex, with

Figure 10. *S. cunninghamii* var. *flindersensis* (holotype: *H. Amtsberg s.n.* AD).

Figure 11. *S. hypoleucus* (*A.C. Beauglehole 87552 & L. Heubner* MEL).

Figure 12. *S. odoratus* (*A.R.R. Higginson* MEL).

resin ducts fine, pale to reddish; inner phyllaries with 1 or 2 ducts. *Florets* 11–14; corolla 5–7 mm long, with lobes 0.8–1.0 mm long. *Achenes* narrow-obloid, 1.8–2.2 mm long, brown, with papillose hairs forming bands 3 or 4 hairs wide, with l:w ratio of hairs c. 5. *Pappus* 4–5 mm long. (Figs 1h, 11)

Flowers mostly late spring–summer.

Distribution and Habitat: Occurs in south-eastern South Australia on the Fleurieu Peninsula and in western Victoria on Mt Arapiles and Mitre Rock near Natimuk (Fig. 7d). Grows in rocky sites, including granite and sandstone outcrops, and in gullies in forest and woodland.

Notes: Relatively common in the Mount Lofty Ranges in South Australia and in this region it hybridises with *S. odoratus* and the introduced species, *S. pterophorus* DC.

Selected specimens examined: **SOUTH AUSTRALIA**: Mount Lofty Range, Between first and second waterfalls, Morialta Gorge, ca 10 km east of Adelaide, *R. Schodde* 1035, 25.xii.1958 (AD, CANB). **VICTORIA**: Mount Arapiles–Tooan Park, Mitre Rock, *J.E. Tonkin 377 & J.H. Ross*, 13.xii.1995 (MEL).

7. *Senecio odoratus* Hornem., *Hort. Bot. Hafn.* 2: 809 (1815)

Cacalia odorata (Hornem.) Desf., *Cat. Hort. Paris* 400 (1829).

Type: [State unknown], 'Hab. in Nov. Hollandia'; probable syn: MEL [Presumably a specimen grown in botanic garden at Copenhagen from achenes sent from England].

Senecio odoratus Hornem. var. *obtusifolius* J.M.Black, *Trans. & Proc. Roy. Soc. S. Australia* 36: 24 (1912). Type: [South Australia], 'Along the coast at Port Elliot', *J.M. Black*; holo: AD.

Senecio odoratus Hornem. var. *longifolius* M.E.Lawr., *J. Adelaide Bot. Gard.* 7: 289 (1985). Type: [South Australia], Ravine des Casoars [Kangaroo Island], 2 Feb. 1948, *J.B. Cleland*; holo: AD; iso: AD.

Senecio odoratus A.Rich., *Voy. Astrolabe* 2: 109 (1834), *nom. illeg. non* Hornem. (1815). Type: [South Australia], 'Crescit in Nova-Hollandia, loco vulgo dicto Ile des Kangourous [west coast of Kangaroo Island]; holo: P *n.v.*

Shrubs to 1.7 m high, nearly glabrous except for leaves, often glaucous. *Leaves* not or slightly fleshy; mid-stem/mid-branch leaves oblanceolate, elliptic to narrow-elliptic or narrow-oblong, to 14 cm long, with l:w ratio c. 2–15, undivided; base attenuate, cordate or auriculate, commonly somewhat amplexicaul; margin dentate to coarse-dentate, or ± entire; upper surface glabrous or with coarse hairs; lower surface glabrous or cobwebby or with coarse hairs, the coarse portions sometimes somewhat obscured by cobwebby overlay; reticulate venation usually conspicuous, especially below. *Unit inflorescences* typically of c. 20–80 capitula. *Capitula*: calycular bracteoles 3–6, 1.0–2.0 mm long; involucre 3.5–6.0 mm long, c. 1.5–2.0 mm diam., glabrous, sometimes glaucous; phyllaries 7–10; stereome convex, with resin ducts mostly fine, pale, orange or reddish; inner phyllaries with 1 or 2 ducts. *Florets* 10–16; corolla 4–6 mm long, with lobes 0.6–1.0 mm long. *Achenes* narrow-obloid, 1.6–2.8 mm long, brown, with papillose hairs in bands, with l:w ratio of hairs c. 4. *Pappus* 4–5 mm long. (Figs 1i, 12)

Flowers spring–autumn.

Distribution and Habitat: Occurs in southern South Australia east from Pearson Island off the west coast of Eyre Peninsula; in south-western Victoria mostly along the coast; in coastal eastern Victoria, and also in Tasmania (Fig. 7e). Grows on rocky slopes, clifftops, or sand dunes in shrubland, woodland and forest.

Notes: An aromatic species displaying considerable subtle morphological variation

particularly in south-eastern South Australia where it is common. Leaves are usually crowded-dentate and the reticulate venation is usually evident. Common but less consistent features of the leaves include glaucosity and a stem-clasping base.

The two varieties of *S. odoratus* that have been recognised represent the two extremes of leaf length:width ratio; however the range of length:width ratios appears to form a continuum in this species and further characters corroborating these varieties could not be identified in this study. The pattern of variation across all specimens of *S. odoratus* appears to be considerably more complex than is represented by the recognition of these varieties, and therefore it is considered better not to recognise them formally.

The type of *Senecio odoratus* var. *longifolius* is from Kangaroo Island and is characterised largely on the basis of relatively narrow leaves. Plants with similarly narrow leaves occur on islands west of Kangaroo Island, e.g. Pearson Island but these have different capitular features. Plants with relatively broad and crowded leaves correspond to Black's var. *obtusifolius* and these occur along the coast of South Australia between Port Eliot and Victor Harbour.

There is variation in leaf shape, degree of auricular development, development of hair on both surfaces and size and glaucosity of the capitula, but there seems to be no consistent pattern. Plants with leaves attenuate basally and moderately woolly on the lower surface are intermediate between the more common forms of *S. odoratus* and *S. hypoleucus* and may represent specimens of hybrid swarms. The capitula of some forms are smaller than usual and are not glaucous; these are reminiscent of capitula of *S. linearifolius* but without the ligulate florets. Leaf venation, indumentum and dentition are also reminiscent of this species suggesting a close relationship. (Mueller determined a few specimens of *S. linearifolius* as *S. odoratus* var. *radiatus*.)

Hybridisation with other species of the Odoratus group is likely to occur, e.g. in the Flinders Ranges, and hybridisation with disciform species, e.g. *S. glomeratus* Desf. ex Poir. and *S. minimus* Poir., have also been recorded.

Selected specimens examined: **SOUTH AUSTRALIA**: Kangaroo Island. Breakneck River on West Bay Track, Flinders Chase National Park, *B.M. Overton 2416*, 3.i.1994 (AD, MEL). c. 2 km NW of Melrose - Mount Remarkable - new walking track from War Memorial, *I.C. Clarke 2931*, *J. Vaganianee*, *W. Hyke*, & *O. Sherlock*, 17.x.1999 (AD, MEL). **VICTORIA**: South-west. Warrnambool area; Childers Cove, *M.G. Corrick 7904*, 17.xii.1981 (AD, CANB, MEL); Long Forest Flora Reserve, Bacchus Marsh (55 km west of Melbourne), Coimadai Creek area, *V. Stajsic 26*, 27.ix.1990 (HO, MEL, NSW, PERTH). **TASMANIA**: Furneaux Group, Penguin Island, *J.S. Whinray 8428*, date unknown (AD, CANB, HO, MEL, NSW).

Part 2: A revision of *Senecio linearifolius* A.Rich.

Senecio linearifolius is a variable species which, despite its radiate capitula, has a close affinity to the discoid species *Senecio odoratus*. Both species are sometimes glaucous and the nature of the variation in leaf indumentum is similar. Of the radiate species, *S. linearifolius* is probably closest to *S. garlandii*. *Senecio linearifolius* is characterised by small, radiate capitula and relatively large and mostly narrow to very narrow-elliptic undivided leaves with an entire or toothed margin.

Senecio linearifolius occurs in south-eastern Australia, including Tasmania, where it occurs in more mesic environments and can be a dominant component of understorey vegetation especially in disturbed sites such as road verges. On the mainland it occurs mostly on and to the coastal side of the Great Dividing Range, and it occurs from sea-level to alpine altitudes.

The name *Senecio linearifolius* was not adopted until 130 years after the taxon was first recognised. It was known as *S. australis* Willd. through the mid-1800s until the type of *S. australis* was found to be referable to the *S. lautus* complex. The initial misapplication became entrenched by the work of Richard and persisted until the late 1800s

(Belcher 1992). A synonym, *S. dryadeus*, began to be used in Australia from the late 1800s presumably as the use of *S. australis* was shown to be erroneous. However, this name was not validly published by Sieber or Sprengel. Willis (1957) pointed out that this name was validly published in 1888 when Mueller published the name with a description. Well before this, however, several valid names had been published by Richard for forms of this entity and Willis nominated *Senecio linearifolius* A.Rich. as the correct name in 1957.

The site of collection of one the three specimens of *S. linearifolius* from Richard's herbarium is given as Port Jackson. This is likely to be an error as the typical form has not otherwise been collected from that area.

Materials and Methods

Herbarium specimens from all Australian herbaria were examined. This was supplemented with field assessment and collections at several sites in southern Victoria and eastern New South Wales. The nature of the morphological variation was assessed and taxonomically useful characters were identified. Several morphological groups that were largely geographic were elucidated. A small percentage of specimens at geographical interfaces between these groups were intermediate in morphology. Whether these specimens represent occasional hybridisation between groups or a more extensive gradation from one form to the other is unclear, and for this reason it is considered most appropriate to recognise these groups in *Senecio linearifolius* at the level of variety.

Taxonomy

8. *Senecio linearifolius* A.Rich., in J.S.C. Dumont d'Urville, *Voy. Astrolabe* 2: 129 (1834).

Type: [Tasmania], 'Crescit in Novâ-Hollandiâ', *A. Lesson*; holo: P.
[*S. australis auct. non* Willd.: A. Richard, *Voy. Astrolabe* 2: (1834); A.P. de Candolle, *Prodr.* 6: 374 (1838); G. Bentham, *Fl. Austral.* 3: 669 (1867)]

Aromatic perennials, often weakly shrubby, to 2 m high, glabrous or nearly so except on lower surface of leaves, sometimes glaucous. *Stems* becoming many-stemmed from base, branching mostly in upper half. *Leaves* commonly ± thin to coriaceous, rarely somewhat fleshy; leaves in middle to upper third of stems narrow to very narrow-elliptic, narrow-ovate, lanceolate, or linear, 2–20 cm long, 1–40 mm wide, with l:w ratio c. 1.5–30, undivided; base attenuate, truncate, cordate, or variously auriculate, with auricles divided or not, slightly amplexicaul or not; margin entire, denticulate, dentate or serrate; upper surface glabrous, occasionally sparsely appressed-cobwebby, glabrescent, sometimes sparsely and minutely hispid; lower surface glabrous, or variously cobwebby to woolly, with hairs all fine and ± appressed or sometimes spreading; secondary and tertiary venation variably distinct. *Unit inflorescences* of several to many capitula; peduncles finally to c. 15 mm long. *Capitula*: calycular bracteoles 2–6, 1.5–3.0 mm long; peduncle and margin of bracteole glabrous or cobwebby at anthesis, sometimes glaucous; involucre cylindric to weakly campanulate, 2.5–5.5 mm long, 1.5–3.0 mm diam.; phyllaries 7–12(–14); stereome slightly to moderately convex, usually glabrous. *Florets* 12–30; ligulate florets 4–8, ligules 3–8 mm long, with nerves commonly 4; disc florets 4.0–5.5 mm long; limb mostly slightly longer than tube. *Achenes* narrow-obloid or narrow oblong-ellipsoid, 1.3–2.5 mm long, brown, glabrous or with papillose hairs in bands, hairs with a l:w ratio of 2–3; carpopodium small, slightly exserted. *Pappus* 4–6 mm long.

Flowers mostly spring–autumn.

Distribution: Occurs in south-eastern Australia from north-eastern New South Wales south to far eastern Victoria, from there west to south-eastern South Australia, and

Figure 13. Distribution of a. *S. linearifolius* var. *linearifolius*; b. *S. linearifolius* var. *deuticulatus*; c. *S. linearifolius* var. *latifolius*; d. *S. linearifolius* var. *intermedius*.

throughout Tasmania. Naturalised in New Zealand. Grows within a few hundred kilometres of coastlines in medium to high rainfall areas in woodland and forest.

Notes: *Senecio pauciligulatus* A.Rich. resembles *S. linearifolius* but has a few atypical features including opposite panicle branches and ligule number fewer than four. The shape of leaves differs from other forms of the species. It is known only by the type and is considered most likely to be an aberrant specimen. There are eight varieties of *S. linearifolius*.

Key

Note: In the following key, leaves refer to leaves of stems rather than of inflorescence branches. The latter are generally similar to stem leaves and have a similar indumentum, but commonly have a higher length to width ratio, reduced dentition, and different basal morphology. In the descriptions of varieties, the upper-stem leaves are specified as plant specimens are typically broken off in this region and variation in shape and auricle development is more apparent in this region.

1 Lower surface of mature leaves woolly (surface largely to entirely obscured); leaves lacking auricles or auricles present only on uppermost leaves and very small and entire; achenes with papillose hairs (Victoria: Grampians and Strathbogie Ranges)
2 Hairs of lower surface of leaves basally coarse, multicellular and spreading; florets per capitulum 20–30 (Strathbogie Ranges).....**8i.** var. ***graniticola***

2: Hairs of lower surface of leaves entirely fine; florets per capitulum 16–20 (Grampians Ranges).....**8h.** var. ***gariwerdeusis***

1: Lower surface of mature leaves glabrous or slightly to moderately cobwebby (surface only slightly obscured) ; leaves often with prominent and/or divided auricles; achenes glabrous or with papillose hairs (New South Wales, Victoria, Tasmania)

3 Upper-stem leaves with l:w ratio mostly < 10; involucre 3.5–5.5 mm long; achenes glabrous, or if not then lower surface of leaves strongly glaucous or younger growth moderately woolly/cobwebby and ligulate florets 6–8 (New South Wales, east coast of Tasmania)

4 Plants not glaucous; undersurface of leaves slightly to moderately obscured by tangled wispy hairs, developing leaves at first ± densely woolly; upperstem leaves shortly petiolate basally (mostly Northern Tablelands and Coast and South Coast of New South Wales, also Tasmania) .....**8e.** var. ***arachnoideus***

4: Plants usually glaucous; lower surface of leaves glabrous or hairs short and spreading with wispy extensions weakly developed, developing leaves at first not woolly (Central Tablelands and Central Coast of New South Wales)

5 Leaves mostly dentate, commonly with hairs on lower surface, mildly glaucous or occasionally not glaucous; achenes glabrous .....**8f.** var. ***macrodontus***

5: Leaves entire to denticulate, glabrous, strongly glaucous; achenes with papillose hairs (Mt Dangar, north-west of Sydney).....**8g.** var. ***daugareusis***

3: Upper-stem leaves with l:w ratio various, up to 30; involucre 2.5–4(–5) mm long; achenes with papillose hairs (Victoria, Tasmania, Southern Tablelands of New South Wales and Australian Capital Territory)

6 Plant slightly to moderately glaucous; lower surface of leaves usually with scattered, spreading, rather weak multicellular hairs (may need low power magnification), glabrescent (Southern Tablelands of New South Wales, Australian Capital Territory and far north-eastern Victoria). .....**8d.** var. ***intermedius***

6: Plant not glaucous; lower surface of leaves glabrous or indumentum cobwebby (hairs not multicellular and spreading); widespread

7 Margin of stem leaves commonly entire, sometimes callus-denticulate, revolute; l:w ratio of upper-stem leaves 5–30; lower surface of leaves with secondary veins not or only slightly raised; tertiary venation not usually discernible.....**8a.** var. ***linearifolius***

7: Margin of stem leaves denticulate to dentate, often slightly acutely, commonly not or hardly recurved; l:w ratio of upper-stem leaves 1.5–15; lower surface of leaves with secondary veins commonly distinctly raised; tertiary venation usually discernible

8 Leaves to 20 mm wide; upper-stem leaves with l:w ratio 4–15, with base (excluding auricular segments) attenuate to cuneate; auricles consisting of segments almost discontinuous with lamina; teeth frequency along margin of leaves 1–3 per cm (sea-level to montane) .....**8b.** var. ***denticulatus***

8: Leaves to 50 mm wide; upper-stem leaves with l:w ratio 1.5–6, with base broad-cuneate to cordate; auricles typically continuous with lamina; teeth frequency along margin of leaves 3–5 per cm (montane to alpine) .....**8c.** var. ***latifolius***

8a. ***Senecio linearifolius*** A.Rich. var. ***linearifolius***

Plants not glaucous. *Upper-stem leaves* very narrow-elliptic, narrow-lanceolate or linear to narrow-linear, to 15 cm long, with l:w ratio 5–30, commonly > 10; base (excluding auricles) narrow-cuneate to attenuate; auricles often present, largely discontinuous with lamina, entire, with l:w ratio c. 3–6, or with a smaller lobe or segment near base and on

proximal margin; margin entire or callus-denticulate, mostly narrowly revolute; lower surface glabrous or slightly or occasionally moderately ± appressed-cobwebby; secondary venation not or slightly raised; tertiary venation usually obscure. *Inflorescences*: peduncles glabrous or nearly so at anthesis. *Capitula*: involucre 3.0–5.0 mm long, 1.5–2.5 mm diam.; phyllaries 8–13. *Florets* 12–22; ligulate florets 4–8; disc florets 8–14. *Achenes* 1.3–2.0 mm long, brown, with appressed papillose hairs in bands. (Fig. 14)

Distribution and Habitat: Occurs in south-eastern Australia; on the mainland from Tanunda in south-eastern South Australia east through southern Victoria to near Moe in south-central Victoria and disjunctly further east in the far east on the coast; in Tasmania widespread (Fig. 13a). Grows in forest and woodland.

Notes: A form of this variety with very narrow and sometimes slightly woolly leaves occurs in and around the Brisbane Ranges in south-central Victoria. A fleshy-leaved variant occurs in coastal environments in far eastern Victoria. Some specimens in south-western Victoria approach var. *gariwerdensis* in terms of leaf indumentum but they have narrower leaves and better developed auricles. Var. *linearifolius* possibly intergrades with var. *denticulatus* east of Melbourne. Var. *denticulatus* differs from var. *linearifolius* by its denticulate to dentate leaves and more prominent venation on the lower surface.

Selected specimens examined: **SOUTH AUSTRALIA**: Tanunda, *F. Muell.* (MEL). **VICTORIA**: 14 km S of Bendoe, Errinundra Flora Reserve, Goonmirk Rocks, *G.A. Savage 19*, 29.iii.1988 (CBG, MEL); Eynesbury estate. About 8 km S from Melton Post Office, *V. Stajsic 603*, 26.x.1992 (MEL, NSW); Croajingalong National Park, opposite Tullaberga Island, *P.C. Heyligers 84049*, 15.xi.1984 (CANB, MEL); Gabo Island, *J.H. Willis*, 5.xi.1969 (MEL). **TASMANIA**: Blythe River Crossing, 4 km W of South Riana, *P.C. Jobson 3390*, 26.ii.1995 (HO, MEL, NSW); Flinders Island, South Patriarch Trig., 20 km NE of Whitemark, *I. Crawford 1109*, 8.xii.1988 (CBG, HO, PERTH); Everall's Point. 3 km north of Coekle Creek, *A.E. Orchard 5299*, 26.i.1981 (AD, BRI, CANB, HO, MEL, NSW).

8b. ***Senecio linearifolius*** var. ***denticulatus*** I.Thomps., *var. nov.*

A varietate typica, foliis denticulatis vel dentatis, rete venularum prominentiore differt.

Type: Victoria, Tali Karng, Gippsland, *T.B. Muir 2978*, 31 Dec. 1963; holo: MEL.

Plants not glaucous. *Upper-stem leaves* very narrow-elliptic, narrow-lanceolate or linear, with l:w ratio 4–15; base (excluding auricles) cuneate; auricles if present ± disjunct from lamina, with l:w ratio c. 3–6, lobes or segments 1 or 2; margin denticulate or dentate/serrate, mostly not or only minutely recurved or revolute, teeth frequency usually c. 1–3 per cm; lower surface glabrous or somewhat cobwebby; secondary venation usually distinct, raised; tertiary venation usually faintly discernible. *Inflorescences*: peduncles glabrous or nearly so at anthesis. *Capitula*: involucre 2.5–4.0 mm long, 1.5–2.0 mm diam.; phyllaries 7–11. *Florets* 12–22; ligulate florets 4–8; disc florets 8–14. *Achenes* 1.5–1.8 mm long, brown, with appressed papillose hairs in bands. (Fig. 15)

Distribution and Habitat: Occurs in far south-eastern Australia; from the Dandenong Ranges in south-central Victoria east to Mallacoota in far eastern Victoria, in far south-eastern New South Wales as far N as Mt Gingera on the border with the Australian Capital Territory, in far north-eastern Tasmania and adjacent islands in the Furneaux Group, and in south-eastern Tasmania (Fig. 13b). Grows mostly in forest.

Etymology: The epithet alludes to leaf margins which are commonly denticulate.

Notes: Similar to var. *linearifolius* but leaf margins of stem leaves are always at least denticulate, secondary venation of the lower surface is more prominent and tertiary venation is more distinct. The two varieties possibly intergrade in eastern Victoria east of Melbourne. There are no definite records of this variety from New South Wales; however it is likely to occur in the far south-east of that state. A specimen from Jigamy Creek

National Herbarium of Victoria (MEL)
Senecio linearifolius A.Rich. var linearifolius
Seen for Flora of Australia
Determinavit I.R. Thompson Apr 2003
National Herbarium of Victoria (MEL)
Senecio linearifolius A.Rich. var linearifolius
AVH Annotation. Nov 2002
MEL 598405
TASMANIAN HERBARIUM, HOBART
FLORA OF Tasmania
DISTRICT
coll A.E. Orchard
no 5299
Date 26 Jan. 1981
Lat 43° 34' S
Long 146° 54' E
Senecio linearifolius A. Rich.
This line for computer entry only. Not to be cited in papers
Locality: Everalls Point. 3km north of Cockle Creek.
Habitat Frequently on roadsides and disturbed areas.
Habit Shrub 2m.
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Figure 14. *S. linearifolius* var. *linearifolius* (*A.E. Orchard 5299* MEL).

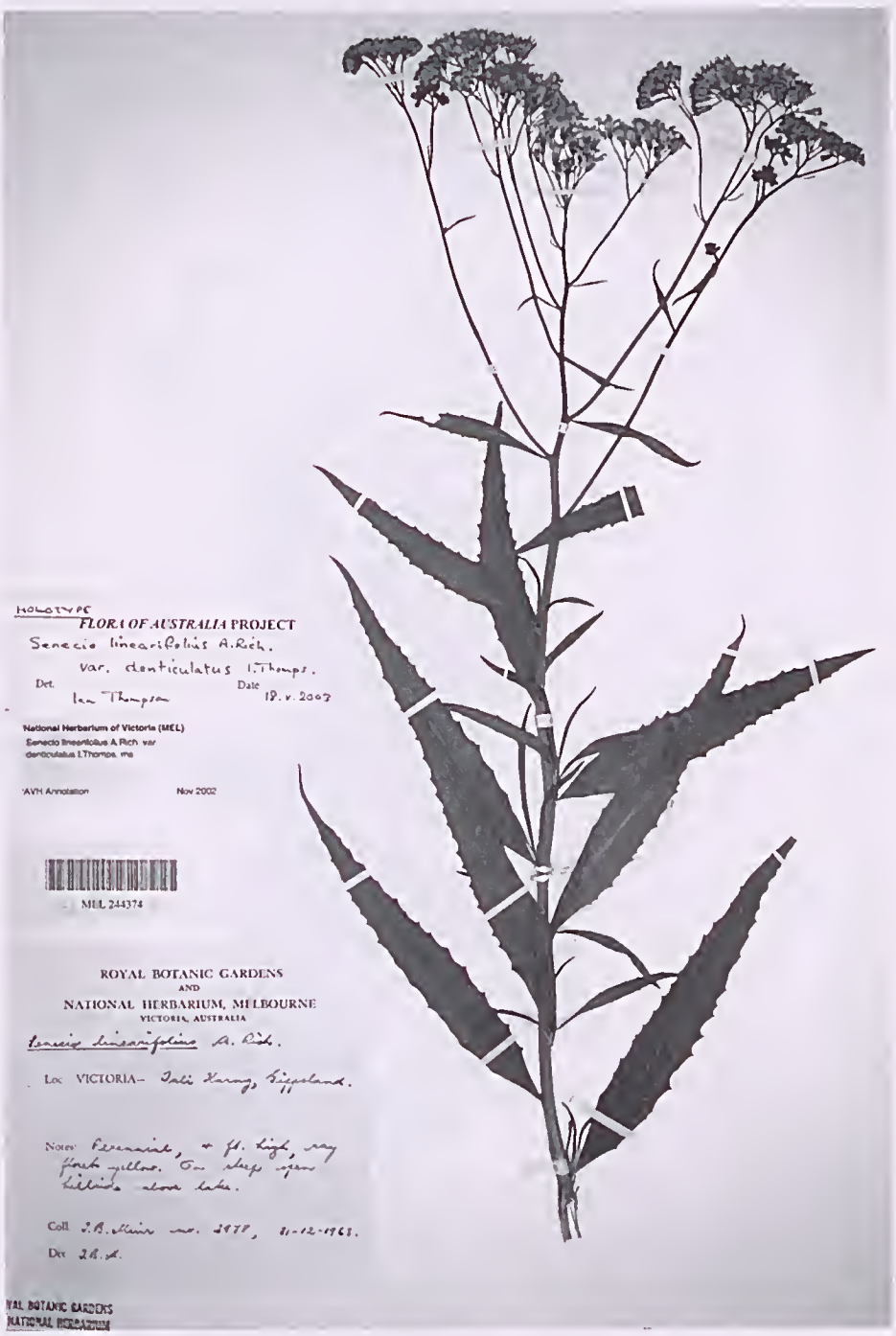

Figure 15. *S. linearifolius* var. *denticulatus* (holotype: *T.B. Muir 2978* MEL).

near Eden (*T.B. Muir 2472*) appears to be intermediate between var. *arachnoideus* and var. *denticulatus*. Also similar to and intergrades with var. *latifolius* q.v. which occurs at higher altitudes.

Selected specimens examined: **VICTORIA**: Walkerville, *S.I. Ali*, 5.xi.1961 (MEL); Alfred National Park, *A.C. Beauglehole 32078 & E.W. Finck*, 25.xi.1969 (MEL); Mt Buffalo 12 miles [19 km] up the road, *S.I. Ali*, 1962 (AD, HO, MEL); Drummer State Forest, East Gippsland. Horseshoe Road, at bridge which is ca. 2.1 km N of Princes Highway T.O., *T.J. Christensen 292*, 29.iv.1984 (AD, MEL); 14 km S of Bendoc, Errinundra Flora Reserve, Goonmirk Rocks, *G.A. Savage 19*, 29.iii.1988 (CBG, MEL). **TASMANIA**: Mt Kerford, Cape Barren Island, *P. Cullen*, 11.xii.1989 (HO); Lower Marsh Creek, *A.M. Buchanan 11830*, 27.xii.1990 (HO).

8c. *Senecio linearifolius* var. *latifolius* I.Thomps., *var. nov.*

A varietate typica, foliis 1.5–6plo longioribus quam latioribus basi truncata vel cordata margine dentato differt.

Type: Australian Capital Territory, Namadgi National Park, Leura Gap, c. 3 km direct NNW of Bimberi Peak, *A.M. Lyne 1961 & D. Mallinson*, 5 Mar. 1996; holo: CANB; iso: AD, MEL, NSW.

Plants not glaucous. *Upper-stem leaves* narrow-elliptic or lanceolate, to 14 cm long, with l:w ratio 1.5–5(–6); base broad-cuneate, truncate, or cordate; auricles sometimes present, usually continuous with lamina, entire or with a much smaller second lobe present; margin denticulate or dentate/serrate, minutely recurved, teeth usually crowded, frequency c. 3–5 per cm; lower surface glabrous or nearly so, rarely cobwebby; secondary venation usually sharply raised; tertiary venation usually clearly discernible. *Branch leaves* with l:w ratio 2–8. *Inflorescences*: peduncles glabrous or nearly so at anthesis. *Capitula*: involucre 2.5–4.0 mm long, 1.0–1.6 mm diam.; phyllaries 8–11. *Florets* 12–19; ligulate florets 4–5; disc florets 8–14. *Achenes* 1.5–2.0 mm long, brown, with appressed papillose hairs in bands. (Fig. 16)

Distribution and Habitat: Occurs in far south-eastern Australia from Powelltown in south-central Victoria east-north-east to the Brindabella Ranges in the Australian Capital Territory (Fig. 13c). Grows at altitudes over 1000 m in forest and woodland.

Etymology: The epithet alludes to the leaves that are broad especially relative to their length(L. *latus*, broad and *folius*, leaf).

Notes: A variety with upper-stem leaves commonly lanceolate and with a low length:width ratio, broad-cuneate to cordate at the base with auricles continuous with the lamina, and the lower surface usually glabrous and with distinct reticulate venation. Capitula are at the smaller end of the range for the species. Some specimens seen are intermediate between this variety and var. *denticulatus* which occurs at lower altitudes.

Selected specimens examined: **NEW SOUTH WALES**: Southern Tablelands. South side of Alpine Way, 11 km south-west of Thredbo, *P. Jobson 447*, 24.i.1989 (MEL, NSW); 7 miles from Guthega, *S.I. Ali*, 19.1.1962 (MEL, NSW); Gibraltar Creek Falls, *C.R. Dunlop 245*, 27.xii.1968 (CBG). **AUSTRALIAN CAPITAL TERRITORY**: Summit area of Mt Gingera; Cotter River District, *R.D. Hoogland 8469*, 28.ii.1962 (CANB, MEL). **VICTORIA**: Echo Flat, Lake Mountain, 21 km ENE of Marysville, *P.C. Jobson 1959*, 28.ii.1993 (MEL); Granite Flat, on Mitta River, ca. 50 km SSE of Tallangatta, *J.M. Wilson*, 24.xii.1961 (MEL); About 5 miles [8 km] south of Harrietville on the Alpine Highway, *L.A. Craven 1555*, 2.ii.1969 (CANB, MEL, NSW); Mt Buffalo National Park, NE Alps, *J.H. Willis*, 21.ii.1963 (MEL); Blue Range Rd. near the crossing at Storm Creek, *M.G. Corrick 8587*, 2.1.1983 (AD, CBG, MEL); Bogong High Plains. Lookout on McKay Portal Road, *S.I. Ali*, 12.i.1962 (HO, MEL).

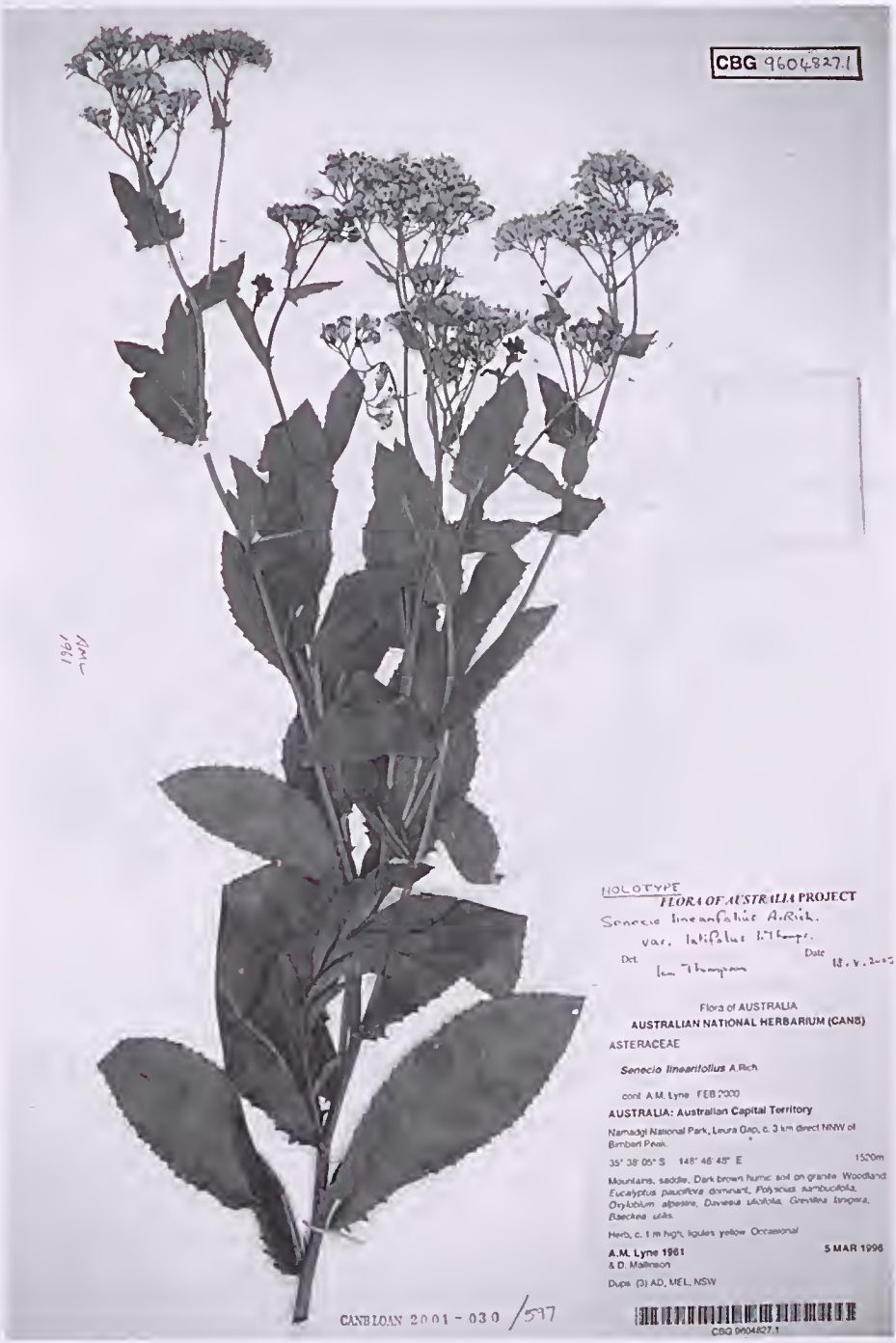
CBG 9604827.1
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio linearifolius A.Rich.
var. latifolius B.Thomps.
Det. Ian Thompson
Date 18.v.2000
Flora of AUSTRALIA
AUSTRALIAN NATIONAL HERBARIUM (CANB)
ASTERACEAE
Senecio linearifolius A.Rich.
coll A.M.Lyne FEB 2000
AUSTRALIA: Australian Capital Territory
Namadgi National Park, Leura Gap, c. 3 km direct NNW of Bimberi Peak.
35° 38' 05" S 148° 46' 45" E 1520m
Mountains, saddle. Dark brown humic soil on granite. Woodland Eucalyptus pauciflora dominant, Polyscias sambucifolia, Oxylobium alpestre, Daviesia latifolia, Grevillea lanigera, Baeckea utilis.
Herb, c. 1 m high, ligules yellow. Occasional
A.M. Lyne 1961
& D. Mallinson
5 MAR 1996
Dups (3) AD, MEL, NSW
CANBLOAN 2001 - 030 /597
CBG 9604827.1

Figure 16. *S. linearifolius* var. *latifolius* (holotype: *A.M. Lyne 1961 & D. Mallinson* CBG).

8d. ***Senecio linearifolius*** var. ***intermedius*** I.Thomps., *var. nov.*

A varietate typica, paginis glaucis, foliis plerumque dentatis pilis patentibus differt.

Type: Victoria, Bridle Creek, ca. 500 m N Ballantyne Gap, 4.5 km by road south of Suggan Buggan, 22 km north of Wulgulmerang, *F.A. Zich 29*, 4 Jan. 1991; holo: CANB; iso: MEL, NSW.

Plants mildly glaucous at least on newer growth. *Upper-stem leaves* narrow to very narrow-elliptic, narrow-lanceolate or linear to narrow-linear, to 12 cm long, with l:w ratio 6–30; base (excluding auricles) attenuate or cuneate; small auricles sometimes present; margin entire, denticulate, or sometimes serrate; lower surface usually glaucous, with weak, coarse, spreading hairs commonly present mostly between veins, glabrescent; secondary venation ± distinct; tertiary venation variably discernible. *Inflorescences*: peduncles mostly glabrous, variably glaucous, rarely cobwebby shortly prior to anthesis. *Capitula*: involucre 3.0–4.0 mm long, 1.6–2.5 mm diam.; phyllaries 8–12. *Florets* 15–22; ligulate florets 4–6, rarely 8; disc florets 11–14. *Achenes* 1.6–2.3 mm long, with appressed papillose hairs in bands. (Fig. 17)

Distribution and Habitat: Occurs in south-eastern New South Wales from Lake George south to Bredbo including localities in the Australian Capital Territory, and in far north-eastern Victoria around Suggan Buggan and Mt Wheeler (Fig. 13d). Grows in forest and woodland.

Etymology: The epithet alludes to its intermediate morphology (see Notes).

Notes: A variety of restricted distribution that is intermediate in morphology, combining the glaucosity and leaves with coarse, spreading hairs of var. *macrodontus*, with the small capitula and papillose-hairy achenes of var. *denticulatus*, var. *latifolius* and var. *linearifolius*.

Selected specimens examined: **NEW SOUTH WALES**: Eastern edge of Lake George, *W.J.M. Streatmens*, Jan. 1958 (CANB, MEL); Southern Tablelands: 'Mirrunga', 5 km WNW of Mt Michelago, *I. Crawford 3494*, 8.xii.1995 (CBG, NSW). **AUSTRALIAN CAPITAL TERRITORY**: Angle Crossing, west side of Murrumbidgee River, on border with N.S.W., *N.M. Taws 462*, 22.x.1995 (CBG, NSW). **VICTORIA**: Suggan Buggan Valley, about 3 miles [5 km] towards Black Mountain, *S.I. Ali*, 15.i.1962 (CANB, HO, MEL); Mt Wheeler, ca. 10 km east of Wulgulmerang, *A.E. Orchard 2659*, 5.xii.1970 (AD, MEL).

8e. ***Senecio linearifolius*** var. ***arachnoideus*** I.Thomps., *var. nov.*

A varietate typica, foliis dentatis, auriculis foliorum latioribus, structuris juvenibus lanatioribus, acheniis plerumque glabris differt.

Type: New South Wales, 10 km east of Nowendoc on Nowendoc–Wingham road, *R.H. Holtkamp 14*, 4 Dec. 1992; holo: MEL; iso: CBG, MEL, NE, NSW.

Plants not glaucous, with immature leaves and stems commonly clothed with a ± dense white wool early in development. *Upper-stem leaves* narrow to very narrow-elliptic, to 12 cm long, with l:w ratio (4.5–)6–12; base (excluding auricles) ± attenuate and petiole-like or cuneate; auricles if present ± disjunct from or only narrowly connected to lamina, sometimes rather large, entire, with l:w ratio 1–3, or more often lobed; margin of leaves mostly denticulate to dentate, not revolute, frequency of teeth 2–5 per cm; upper surface: veins sometimes strongly impressed, at first usually appressed-cobwebby, glabrescent; lower surface with scattered, weak , coarse spreading hairs or moderately cobwebby, the hairs fine or sometimes coarse-based, glabrescent; secondary venation sharply raised; tertiary venation distinct; *Inflorescences*: peduncles often cobwebby at or shortly prior to anthesis. Capitula: involucre 3.5–4.5 mm long, 1.5–2.5 mm diam.; phyllaries 9–13. *Florets* 18–25; ligulate florets 5–8, commonly 6–8; disc florets 13–17. *Achenes* 2.0–2.5 mm long, glabrous, or occasionally with papillose hairs in bands. (Fig. 19)

CANB 0040012
ANHSIR
AUSTRALIAN NATIONAL HERBARIUM (CANB)
Commonwealth Scientific & Industrial Research Organisation; Australia
ASTERACEAE
Senecio linearifolius
Det. F.A. Zich 1992
AUSTRALIA : Victoria
Bridle Creek, ca. 500 m N Ballantyne Gap, 4.5 km by road S of Suggan Buggan, 22 km N Wulgulmerang
36° 58'S 148° 18'E
Alt. 600 m
Creek gully on steep slope; Eucalyptus forest with Dodonaea and Casuinia laevis on shallow sandy loam over granite.
Sparse shrub to 1.5 m tall; rays yellow
Common
Dupe: NSW,MEL,PRE,A, MO
F.A. Zich 29
4 Jan 1991
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio linearifolius A.Rich.
var. intermedius I.Thomp.
Det Ian Thompson Date 15 x 2003
CANBION 2001 - 030/675

Figure 17. *S. linearifolius* var. *intermedius* (holotype: *F.A. Zich 29* CANB).

Figure 18. Distribution of a. *S. linearifolins* var. *arachnoidens*; b. *S. linearifolius* var. *macrodontus*; c. *S. linearifolins* var. *dangarensis*; d. *S. linearifolius* var. *graniticola*; e. *S. linearifolius* var. *gariwerdensis.*

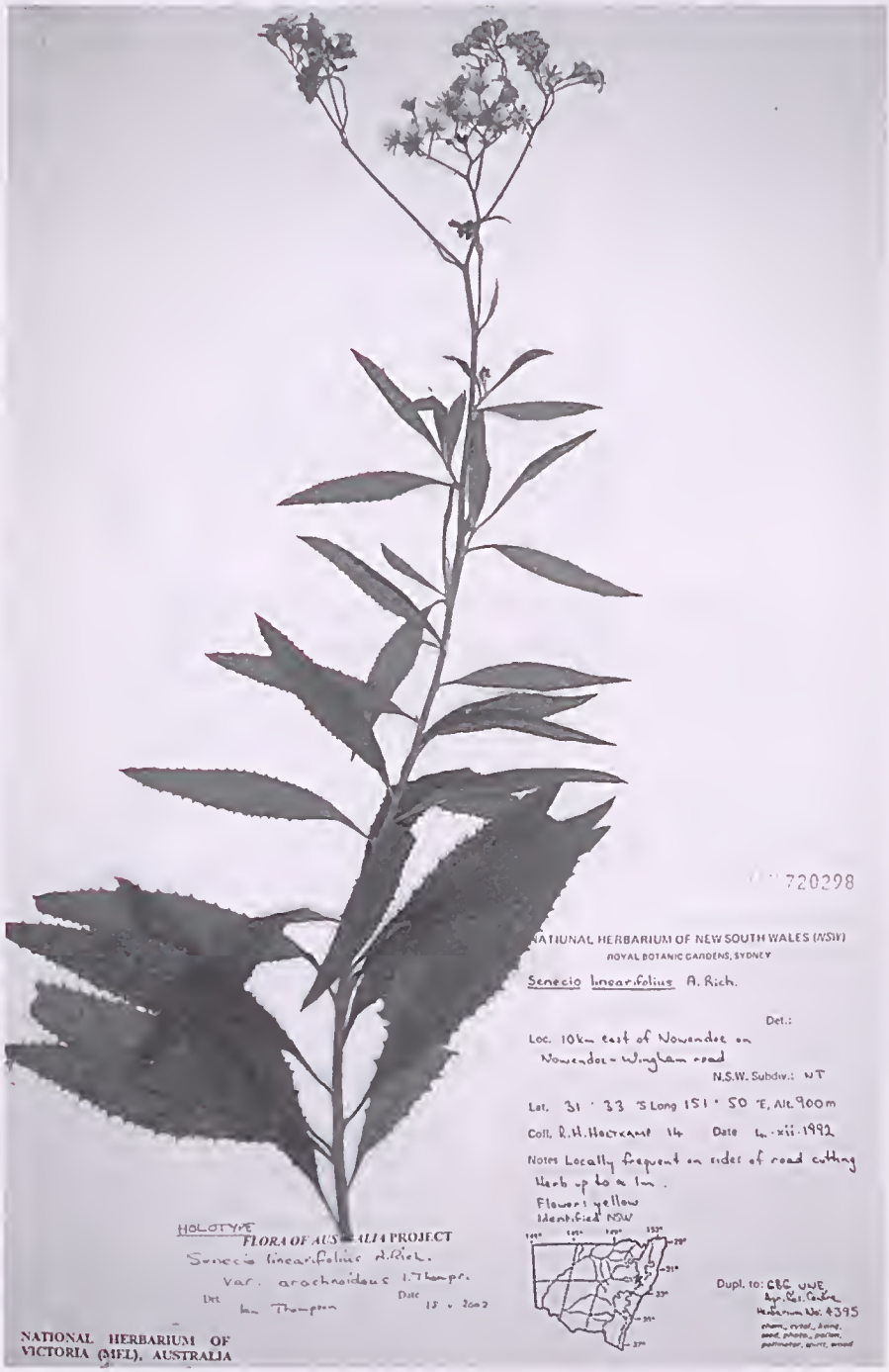
720298
NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)
ROYAL BOTANIC GARDENS, SYDNEY
Senecio linearifolius A. Rich.
Det.:
Loc. 10km east of Nowendoc on
Nowendoc - Wingham road
N.S.W. Subdiv.: NT
Lat. 31 ° 33 'S Long 151 ° 50 'E, Alt. 900m
Coll. R.H. Hoctkamp 14 Date 4.-xii-1992
Notes Locally frequent on sides of road cutting
Herb up to a 1m.
Flowers yellow
Identified NSW
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio linearifolius A.Rich.
var. arachnoideus I.Thomps.
Det Ian Thompson Date 15 . 2002
NATIONAL HERBARIUM OF
VICTORIA (MEL), AUSTRALIA
Dupl. to: CBG, UWE
Herbarium No: 4395

Figure 19. *S. linearifolius* var. *arachnoideus* (holotype: *R.H. Holtkamp 14* MEL).

Distribution and Habitat: Occurs in eastern New South Wales from Tenterfield in the far north south to Mt Royal and disjunctly further south from Bulli Pass south to Green Cape in the far south. Also a single record from the east coast of Tasmania at Mayfield Beach (Fig. 18a). Grows in forest and coastal scrub.

Etymology: The epithet alludes to the cobwebby undersurface of its leaves (L. *arachnoideus*, resembling a spiderweb)

Notes: Similar to var. *denticulatus* but differs by having glabrous achenes, (although papillose-hairy at southern limits of range), by having a denser indumentum, by leaves being more reduced in width basally and with relatively broader auricles and auricle-lobes, and with slightly larger capitula with more ray florets. The petiole-like, dentate leaves of var. *arachnoideus* are sometimes reminiscent of leaves of *Senecio amygdalifolius*, a species with much larger capitula.

Selected specimens examined: **NEW SOUTH WALES**: Pigeon Top and track, c. 3000' [950 m], 12 miles south of Nowendoc, *J. Carrick 3289*, 7.xi.1972 (AD, MEL); Tantawangalo State Forest, spur between Devils Creek and McCartheys Creek, *I. Crawford 1206*, 22.viii.1990 (CBG, MEL, NSW); Broekelos Creek crossing on Bega to Bermagui Road, c. 15 km S of Bermagui, *L. Haegi 1736*, 9.ii.1979 (MEL, NSW); Near summit of Brown Mountain; west side. 14 miles [24 km] east of Nimmitabel on the Bega road, *M. Evans 2594*, 21.iv.1967 (AD, CANB, MEL, NSW); c. 9 km from Catheart along road to Burragate, *P.S. Short 4014*, 6.ii.1993 (CANB, MEL, NSW). **TASMANIA**: North end of Mayfield Beach. *A.M. Buchanan 8627*, 10.vi.1986 (HO).

8f. *Senecio linearifolius* var. *macrodontus* (DC) I.Thomps., *comb. nov.*

S. persicifolius A.Rich., *Voy. Astrolabe* 2: 123 (1834), *nom. illeg. non* Ram. (1799); *S. macrodontus* DC., *Prodr.* 6: 373 (1838); *S. australis* var. *macrodontus* Benth., *Fl. Austral.* 3: 669 (1867); *S. dryadeus* var. *macrodontus* (DC.) Ewart, *Fl. Victoria* 1176 (1931), *nom. inval., p.p. Type:* [New South Wales], Nova Hollandia, Port Jackson, 1828, *A. Lesson*; holo: P.

S. dryadens Spreng., *Syst. Veg.* 3: 562 (1826) *nom. inval.* [cited in synonymy]. Type: [New South Wales], Novae Holl., *Sieber 337*, [1823]; syn: MEL.

S. cinerarioides A.Rich., *Voy. Astrolabe* 2: 128 (1834), *nom. illeg. non* Kunth (1820); *S. richardianus* DC., *Prodr.* 6: 373 (1838). Type: [New South Wales], Port Jackson, *C. Gaudichaud 348*; holo: P.

Plants slightly to moderately glaucous on stems, leaves (particularly lower surface), peduncles and capitula. *Upper-stem leaves* narrow to very narrow-elliptic, with l:w ratio 5–8; base (excluding auricles) attenuate, cuneate, or cordate; auricles if present narrowly to broadly connected to lamina, entire or once lobed; margin of leaves denticulate to dentate, frequency of teeth 3–5 per cm; lower surface usually with scattered, spreading, coarse hairs, with or without short wispy extensions; secondary venation sharply raised; tertiary venation usually discernible. *Inflorescences*: peduncles glabrous. *Capitula*: involucre 4.5–5.0(–5.5) mm long, 1.8–2.8 mm wide; phyllaries mostly 9–12. *Florets* 18–25; ligulate florets mostly 5–8; disc florets 13–17. *Achenes* 2.0–2.5 mm long, glabrous. (Fig. 20)

Distribution and Habitat: Occurs in central-eastern New South Wales from Barrington Tops south to Saddleback Mountain (Fig. 18b). Grows in basaltic and sandstone-derived loams and sand in dry and wet forest and in woodland.

Notes: Similar to var. *arachnoideus* which also has glabrous achenes. The distribution of var. *arachnoideus* is to the north and south of var. *macrodontus*. Var. *macrodontus* differs by having glaucous leaves, stems and peduncles, by having leaf-bases cuneate rather than petiole-like, by having newer growth more sparsely haired, and by having slightly

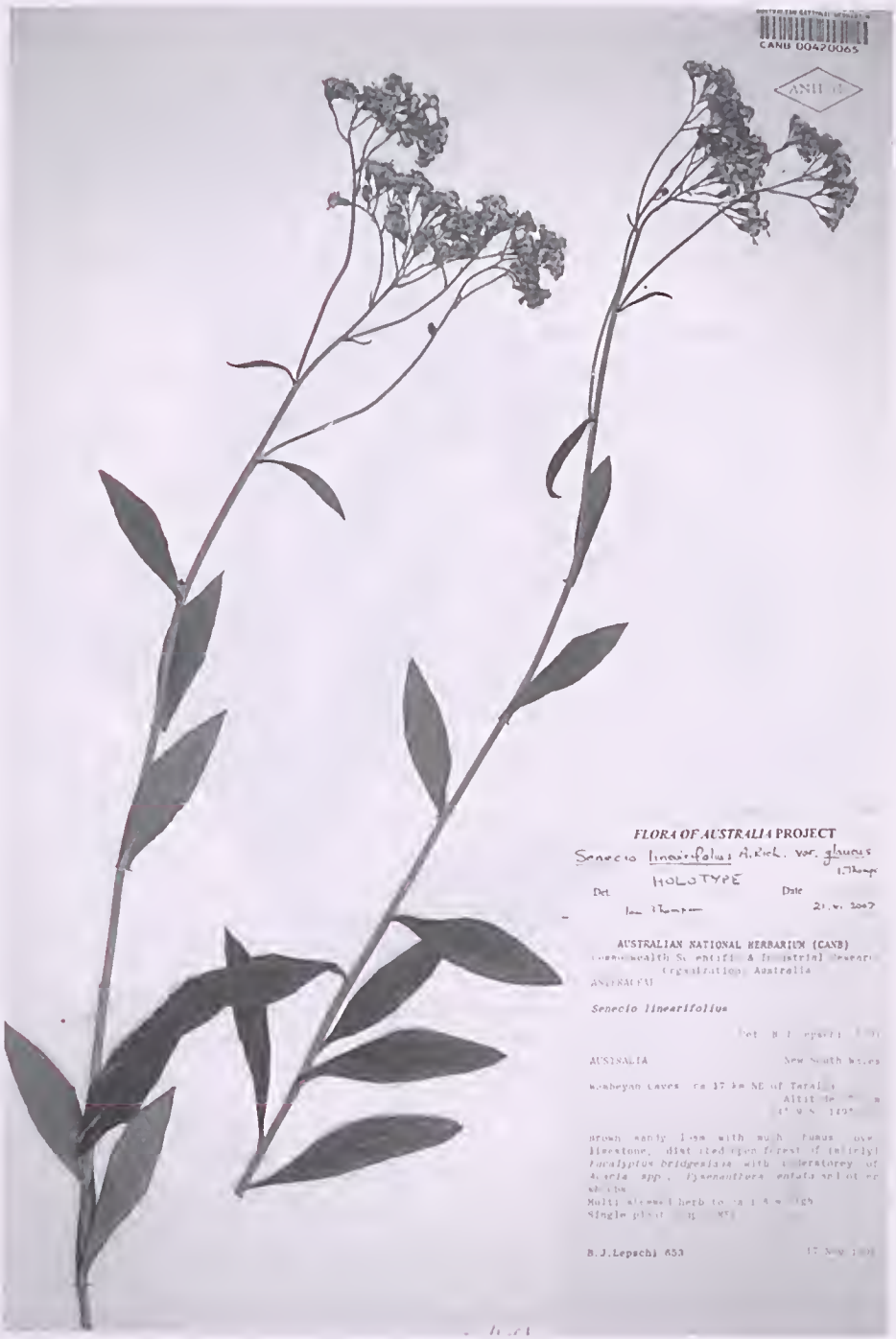

Figure 20. *S. linearifolius* var. *macrodontus* (*B.J. Lepschi 653* CANB).

longer capitula. In the Barrington Tops area plants sometimes have cobwebby as well as glaucous peduncles. The specimen in Fig.20 and specimens returned to several Australian herbaria have been incorrectly determined with a manuscript name *S. linearifolius* var. *glaucus* I.Thomps.

Selected specimens examined: **NEW SOUTH WALES**: 287B Kangaroo Valley Road, Berry, *E.H. Norris 461*, 5.i.1986 (MEL, NSW); Katoomba, Ruined Castle Track from bottom of Golden Stairs, *W. Bishop 452 & J. Brown*, 29.iii.1986 (MEL, NSW); The Gib, Mittagong, *C. Burgess*, 6.i.1962 (CANB); Booderee National Park, 1 km at 124° from Budderoo Geodetic Station, *I. Crawford 938*, 13.vii.1988 (CBG, NSW); Jervis Bay, W end of Steamers Beach, *R.J. Rudd 127, A.M. Lyne, B. Rafferty & M.Kubis*, 30.viii.1991 (CBG); Coricudgy State Forest, Mt Darcy, c. 2 km E from summit on The Army Road, *F.E. Davies 1632, G. Butler & G. Corsini*, 10.xii.1991 (CBG, NSW, PERTH); 35.1 km from Hartley on road to Jenolan Caves, *M.E. Lawrence 1388*, 28.xii.1978 (AD).

8g. *Senecio linearifolius* var. *daugarensis* Belcher ex I.Thomps., *var. nov.*

A varietate typica, paginis glaucis, foliis latioribus sine auriculis, capitulis majoribus, flosculis ligulatis pluribus differt.

Type: New South Wales, Mt Dangar, southeast of Gungal, *R.O. Belcher 2678*, 13 Dec. 1986; holo: NSW.

Senecio sp. C *sensu* G.J. Harden *in* G.J. Harden, *Fl. New South Wales* 4: 311 (1992).

Plants glaucous, in parts strongly so, on stems, lower surface of leaves, peduncles and capitula ± glabrous. *Upper-stem leaves* narrow to very narrow-elliptic, with l:w ratio 5–8; base cuneate to broad-cuneate; auricles absent; margin denticulate; lower surface glabrous; secondary venation ± distinct; tertiary venation distinct. *Inflorescences*: peduncles glabrous, or rarely cobwebby, at anthesis. *Capitula*: involucre 3.5–5.0 mm long 2.0–2.8 mm diam.; phyllaries mostly c. 12. *Florets* 20–31; ligulate florets mostly 7–9; disc florets 13–22. *Achenes* c. 2.0 mm long, with appressed papillose hairs in bands. (Fig. 21)

Distribution and Habitat: Occurs only on Mt Dangar, south-east of Gungal (Fig. 18c). Grows on a basalt scree on a steep eastern slope.

Etymology: The epithet alludes to the only known locality of this variety.

Notes: This variety is typically the most strongly glaucous of the three glaucous varieties, and unlike var. *macrodontus* and var. *intermedius* the lower surface of leaves are always glabrous. Differs from var. *macrodontus* also by having papillose achenes and differs further from var. *intermedius* by having much larger capitula with more numerous ray and disc florets.

Selected specimens examined: **NEW SOUTH WALES**: Goulburn River National Park, E side of Mt Dangar, c. 70 m below summit, *F.E. Davies 1585, R. Hallett & M.M. Richardson*, 1.v.1991 (CBG, MEL, PERTH); Mt Dongal [Mt Dangar], approx. 32°21' S, 150°29' E, *G.L. Webster 19049 & D.J. McGillivray*, 14.xi.1973 (NSW).

8h. *Senecio linearifolius* var. *gariwerdensis* I.Thomps., *var. nov.*

A varietate typica, foliis majoribus, inferne lanatioribus, acheniis longioribus differt.

Type: Victoria, Grampians, ± 9 km [5 1/2 miles] S of Halls Gap, Glenbower Creek, Grampians Road, *A.C. Beauglehole 16404*, 12 Dec. 1967; holo: MEL.

Plants not glaucous. *Upper-stem leaves* very narrow-elliptic, narrow-lanceolate or linear, to 17 cm long, with l:w ratio c. 7–12; base petiole-like, attenuate, or cuneate; auricles lacking, or uppermost leaves broad-cuneate and sometimes with small, entire auricles; margin entire, callus-denticulate or rarely denticulate, often revolute; upper surface transiently appressed-cobwebby; lower surface densely appressed-woolly; secondary

NSW
LOAN
NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)
ROYAL BOTANIC GARDENS, SYDNEY NSW455251
SENECIO DANGARENSIS BELCHER
HOLOTYPE
Det.: R.O.Belcher
Loc. Mt. Dangar, Southeast of Gungal, N.S.W.
N.S.W. Subdiv.: C.W.S
Lat. 32° 20'S Long 150° 29'E, Alt. c. 600m
Coll. R.O. Belcher 2678 Date 13-12-1986
Notes On open basalt scree on steep eastern slope c. 200m below tail tower
Plant to 1.2m tall; much branched from base, branchlets erect, basal woody; rays 8, yellow, spreading.
Dupl. to:
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio linearifolius A.Rich.
Var. dangarensis L.Thomps.
Det. Len Thomps Date 17 x 2002
PLANTDATA DATABASE

Figure 21. *S. linearifolius* var. *dangarensis* (holotype: *R.O. Belcher 2678* NSW).

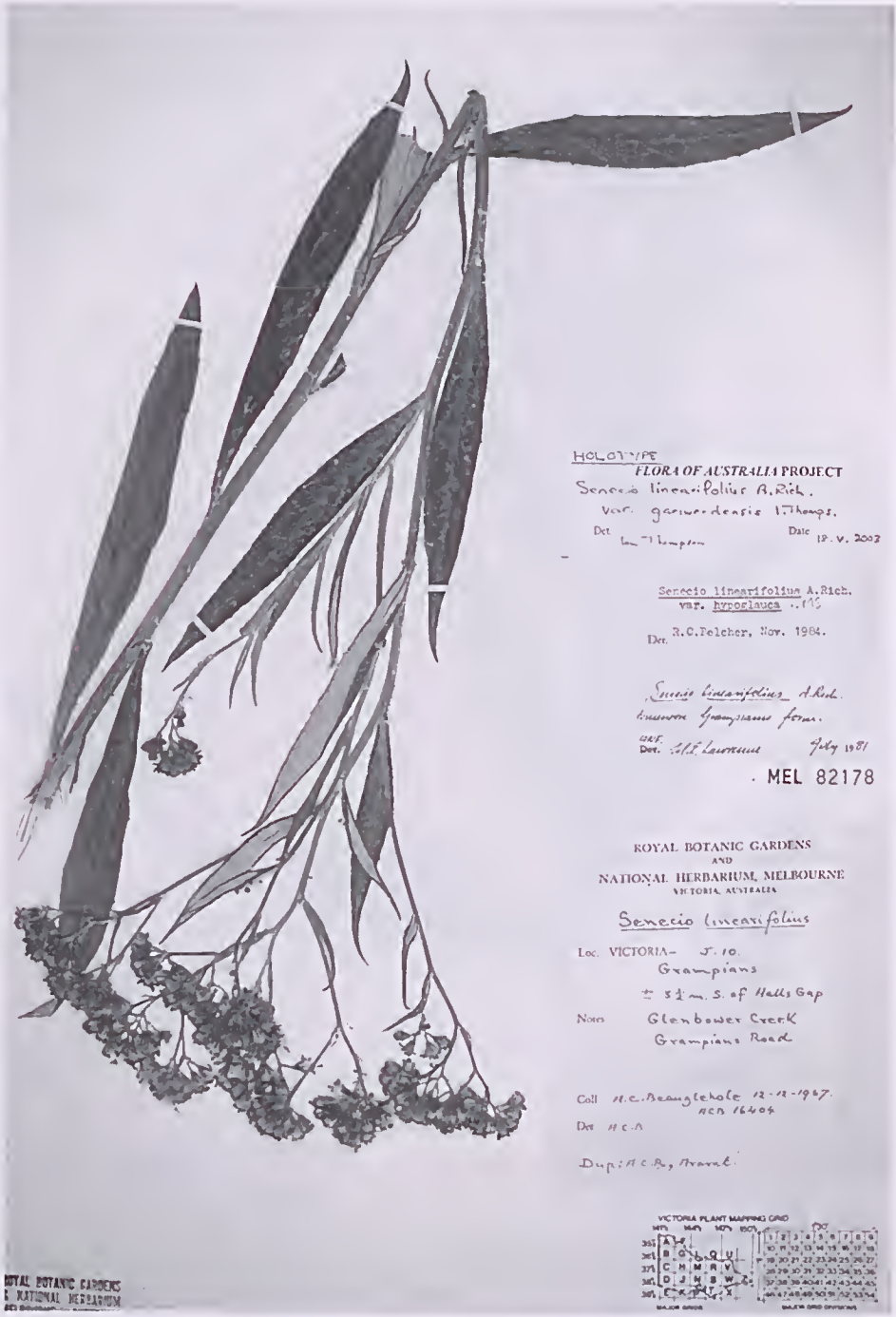

Figure 22. *S. linearifolius* var. *gariwerdensis* (holotype: *A.C. Beauglehole 16404* MEL).

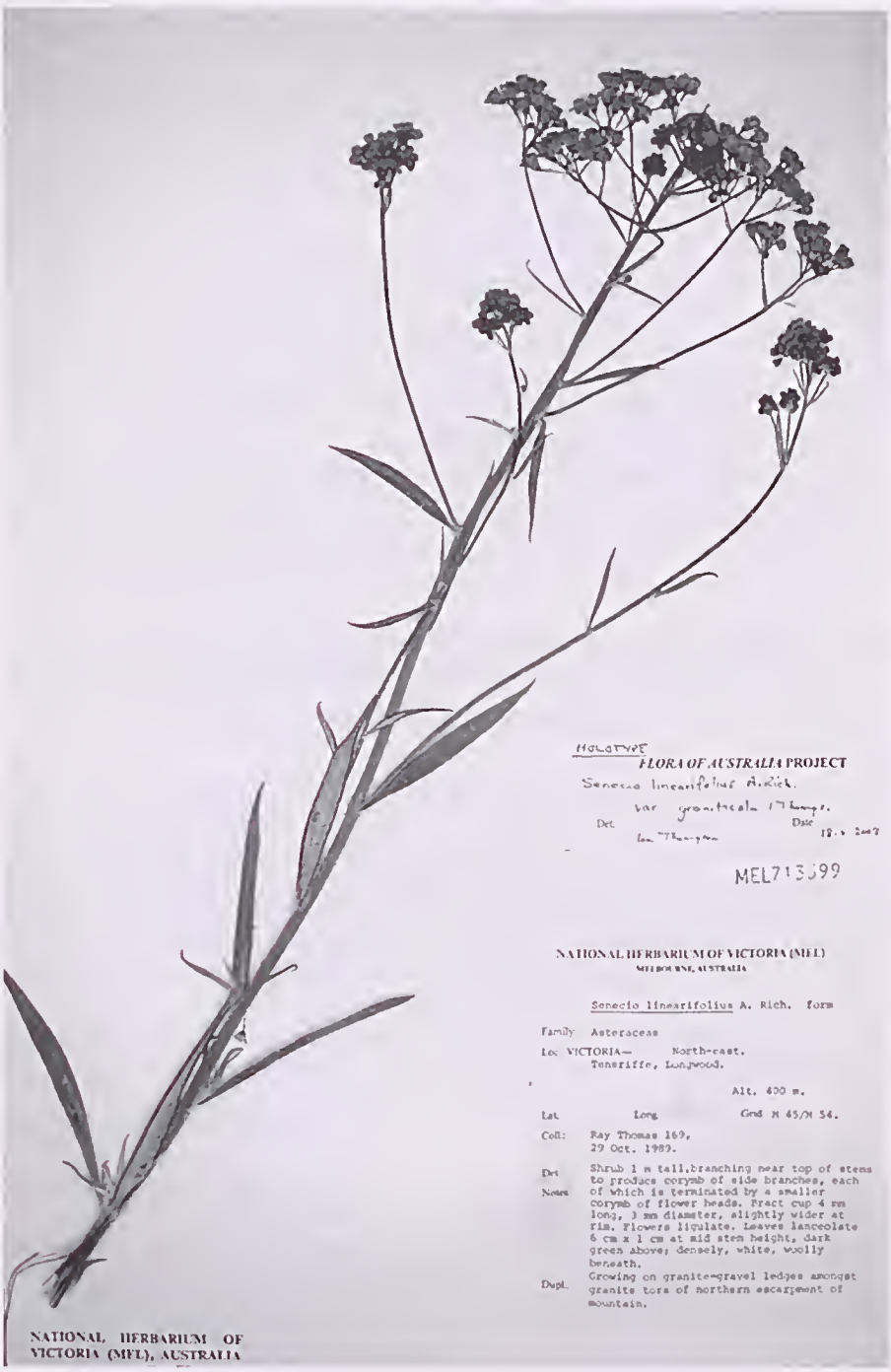
HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio linearifolius A.Rich.
var. graniticola I.Thomps.
Det. I.Thompson
Date 13.9.2007
MEL713099
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Senecio linearifolius A. Rich. form
Family: Asteraceae
Loc: VICTORIA— North-east.
Tenerriffe, Longwood.
Alt. 400 m.
Lat. Long. Grid M 45/M 54.
Coll: Ray Thomas 169,
29 Oct. 1989.
Det.
Notes: Shrub 1 m tall,branching near top of stems to produce corymb of side branches, each of which is terminated by a smaller corymb of flower heads. Fract cup 4 mm long, 3 mm diameter, slightly wider at rim. Flowers ligulate. Leaves lanceolate 6 cm x 1 cm at mid stem height, dark green above; densely, white, woolly beneath.
Dupl.
Growing on granite-gravel ledges amongst granite tors of northern escarpment of mountain.
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Figure 23. *S. linearifolius* var. *graniticola* (holotype: *R. Thomas 169* MEL).

venation usually discernible; tertiary venation usually indistinct. *Inflorescences*: peduncles glabrous or somewhat cobwebby at anthesis. *Capitula*: involucre 3.5–4.5 mm long, c. 1.5–2.0 mm diam.; phyllaries mostly 8–10, occasionally sparsely cobwebby. *Florets* 13–19; ligulate florets mostly 5; disc florets 8–14. *Achenes* 2.0–2.5 mm long, tan or brown, with appressed papillose hairs in bands. (Fig. 22)

Distribution and Habitat: Occurs in the Grampians Ranges in western Victoria from Mt Zero south to Victoria Valley (Fig. 18e). Grows in forest.

Etymology: The epithet alludes to the area to which it is endemic. Gariwerd is an aboriginal word for the Grampians Ranges

Notes: A variety with rather large leaves and a distinctive, dense, appressed wool on the lower surface. The leaf-bases lack auricles, or if present they are small and inconspicuous. Leaves of var *graniticola* have a superficially similar indumentum but the wool overlays and is an extension of coarse hairs evident on close examination. This variety also differs by having smaller leaves and broader capitula with more phyllaries and florets. The typical variety of *S. linearifolius* has also been recorded from the Grampians but is readily distinguished from var. *gariwerdensis*.

Selected specimens examined: **VICTORIA**: Jimmy's Creek, Grampians, at southern foot of Major Mitchell Plateau, *J.H. Willis*, 8.xii.1962 (MEL); 3.8 km north along the Victoria Range track from its intersection with Sawmill Track, *D.E. Albrecht 3105*, 7.iii.1987 (MEL); Mt Zero, Grampians, 24 km SE of Horsham, *H. Streimann 2622*, 11.xii.1975 (CBG, NSW, PERTH).

8i. ***Senecio linearifolius*** var. ***graniticola*** I.Thomps., *var. nov.*

A varietate typica, foliis sine auriculis inferne lanatioribus, flosculis pluribus differt.

Type: Victoria, north-east, Teneriffe near Longwood, *R. Thomas 169*, 29 Oct. 1989; holo: MEL.

Plants not glaucous. *Upper-stem leaves* very narrow-elliptic to linear, to 13 cm long, with l:w ratio c. 8–15; base narrow-cuneate; auricles lacking; margin entire, revolute, occasionally denticulate; upper surface somewhat appressed-cobwebby; lower surface densely woolly, with the wool overlying spreading, coarse, basal portion of hairs; secondary venation generally indistinct. *Inflorescences*: peduncles slightly to moderately cobwebby at anthesis. *Capitula*: involucre 3–4 mm long, c. 2–3 mm diam.; phyllaries mostly 12–14. *Florets* 15–24; ligulate florets 5–8, often more than 5; disc florets 10–16. *Achenes* 1.6–2.0 mm long, with appressed papillose hairs in bands. (Fig. 23)

Distribution and Habitat: Occurs in the Strathbogie Ranges in north-eastern Victoria (Fig. 18d). Grows in soils of granitic derivation in woodland.

Etymology: The epithet alludes to the geology of its habitat (L. *granitus*, granite, and *cola*, dwelling).

Notes: Similar to var. *gariwerdensis* and also to *Senecio garlandii* in terms of lower surface indumentum and in the number of florets per capitula.

Selected specimens examined: **VICTORIA**: Longwood–Ruffy Road, *A.C. Beauglehole 92855*, 23.i.1988 (MEL); Midlands. Neil Devanny's farm, 10 km magnetic S of Euroa. Top of Bushland block on Creighton's Creek escarpment of the range, *R. Thomas 635*, 4.xii.1993 (MEL).

Excluded Names

Senecio dryadeus Ewart, *Fl. Victoria* 1176 (1931). Type: 'Widely spread, except in N.W. Victoria, usually on swampy or damp places, near Melbourne on the basalt and silurian areas, and sporadic after bush fires'.

As no type specimen was cited, it is unclear to which variety *S. dryadeus* Ewart is referable.

Acknowledgements

I am grateful for the assistance given by the School of Botany, University of Melbourne and the Royal Botanic Gardens, Melbourne for the use of their facilities, Neville Walsh for his assistance with field work and many other aspects of my research, Dr Niels Klazenga and Dr Teresa Lebel for their assistance with maps and images, and the technical staff at MEL for their assistance with loans. I would also like to thank the directors of AD, BRI, CANB, DNA, HO, NE and NSW for the loan of specimens. This study was funded by a three-year ABRS grant (Grant No: 2000/3192).

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Index of Scientific Names

Epithets of accepted names are in roman (with bold type for new names) and synonyms are in italics. The numbers refer to the number of the accepted species or subspecies as given in the taxonomy section. 'Excl.' refers to names listed under Excluded names. Key indicates that the name only appears in the Key and Introduction.

Name	No.	Page no.
Cacalia		
odorata (Hornem.) Desf.	7	88
Senecio		
anethifolius A.Cunn. ex DC.	1	70
anethifolius subsp. anethifolius	1a	72
anethifolius subsp. **brevibracteolatus** I.Thomps.	1b	73
angustilobus F.Muell.	1a	72
angustifolius Sond.	1a	72
australis auct. non Willd	8	90
australis Willd. var. *macrodontus* (DC.) Benth.	8f	102
behrianus Sond. & F.Muell. ex Sond.	key	

Name	No.	Page no.
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cinerarioides A.Rich.	8f	102
cunninghamii DC.	5	81
cunninghamii DC. var. cunninghamii	5a	81
cunninghamii var. **flindersensis** I.Thomps.	5b	84
cunninghamii var. *serratus* M.E.Lawr.	4	78
dryadeus Spreng.	8f	102
dryadeus Ewart	Excl.	
dryadeus var. *macrodontus* (DC.) Ewart	8f	
euclaensis I.Thomps.	2	77
garlandii F.Muell. ex Belcher	key	***
gawlerensis M.E.Lawr.	3	77
georgianus DC.	key	***
georgianus DC. var. *latifolius* J.M.Black	3	77
gilbertii Turcz.	key	***
hypoleucus F.Muell. ex Benth.	6	84
lanibracteus I.Thomps.	4	78
leucoglossus F.Muell.	key	***
lincarifolius A.Rich.	8	90
linearifolius var. **arachnoideus** I.Thomps.	8e	98
linearifolius var. **dangarensis** I.Thomps.	8g	104
linearifolius var. **denticulatus** I.Thomps.	8b	93
linearifolius var. **gariwerdensis** I.Thomps.	8h	104
linearifolius var. **graniticola** I.Thomps.	8i	108
linearifolius var. **intermedius** I.Thomps.	8d	96
lincarifolius var. **latifolius** I.Thomps.	8c	96
linearifolius var. **macrodontus** I.Thomps.	8f	102
linearifolius A.Rich. var. linearifolius	8a	102
odoratus Hornem.	7	88
odoratus A.Rich.	7	88
odoratus var. *longifolius* M.E.Lawr.	7	88
odoratus var. *obtusifolius* J.M.Black	7	88
odoratus var. *odoratus*	7	88
odoratus var. *petiolata* Sond.	6	84
pauciligulatus A.Rich.		91
persicifolius A.Rich.	8f	102
ramosissimus DC.	key	***
richardianus DC.	8f	102
vulgaris L.	key	***

Muelleria 20: 111–138 (2004)

Taxonomic Studies of Australian *Senecio* (Asteraceae): 3. Radiate, arid region species allied to *S. magnificus* and the radiate, alpine species *S. pectinatus*

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Abstract

A morphological study of Australian radiate species of *Senecio* and *Othonna* have resulted in a number of taxonomic changes. From a group of species allied to *Senecio magnificus* F.Muell., predominantly from arid and semiarid regions, the following taxonomic changes are made: *Senecio pilosicristus* I.Thomps. and *S. conferruminatus* I.Thomps. are described as new, *S. tuberculatus* Ali is resurrected, *Othonna gypsicola* R.Bates is recombined as *Senecio gypsicola* (R.Bates) I.Thomps., and *Othonna gregorii* (F.Muell.) C.Jeffrey is returned to *Senecio*. Descriptions of the remaining species in this group are also presented. A radiate *Senecio* of alpine regions, *S. pectinatus* DC. var. *ochroleucus* F.Muell., is elevated to the rank of species as *S. albogilvus* I.Thomps. A key to all of Australia's radiate species of *Senecio* is presented.

Introduction

Certain radiate species of *Senecio* in Australia, predominantly of arid and semiarid regions, appear to form a natural group. They are characterised by glaucosity, relatively large capitula, calycular bracteoles lacking or few, achenes variously clothed in papillose hairs or papillae, and, for the most part, a persistent pappus. The taxonomy of this group, hereafter informally described as the Magnificus group, is the subject of first part of this paper.

One of the species treated here as a member of this group was first described as *Senecio gregorii* F.Muell. in 1859, but in 1986 it was transferred to the South African genus *Othonna* (Jeffrey 1986). Jeffrey cited a sharing of characteristic features with the yellow-flowered succulent species of this genus. However, the information given was scanty and which of the list of features Jeffrey gave for the othonnoid complex that *O. gregorii* (F.Muell.) C.Jeffrey shares was not specified except for 'ecalyculate involucres with tendency to united phyllaries'. Jeffrey conceded that *O. gregorii* was atypical of this *Othonna* group in possessing female fertile disc florets. The disc florets of *O. gregorii* also differ in having a divided style.

In 1993, Bates described a new species similar to *O. gregorii* in terms of the fusion of phyllaries, and named it *Othonna gypsicola* R.Bates following the lead of Jeffrey. However, Bates, like Jeffrey, was uncertain of this decision, and indicated that although *O. gregorii* and *O. gypsicola* are discordant in *Senecio*, both are also discordant in *Othonna*.

Othonna gypsicola appears to provide a morphological bridge between *O. gregorii* and other large-headed radiate species of arid and semiarid regions, most notably *Senecio magnificus* and *S. megaglossus*. The gametic chromosome number for *Othonna* is 10 (Nordenstam 1967). In contrast, the gametic chromosome numbers obtained for both *O. gregorii* (Ornduff *et al.*, 1963, Lawrence 1980) and *S. magnificus* (Lawrence 1980) is 20. The weight of evidence, I believe, does not favour the placement of *O. gregorii* and *O. gypsicola* in *Othonna*, and the necessary new combination is made for the latter below.

In the course of this study, two new species have come to light, one most closely allied to *S. gregorii* and the other to *S. magnificus*.

Senecio tuberculatus, described in 1965 (Ali, 1965), was synonymised under *S.*

murrayanus Wawra by Belcher (1986) upon discovery of the type of the latter. Although closely related, several differences readily distinguish *S. tuberculatus* from *S. murrayanus*.

In the second part of this paper, the taxonomy of the radiate alpine *Senecio*, *S. pectinatus* DC. is reassessed. *Senecio pectinatus* is one of a group of Australian scapiform, alpine or sub-alpine species. *Senecio pectinatus* var. *ochroleucus* F.Muell. is removed from *S. pectinatus* and is elevated to the rank of species. It is distinctive in having creamy-white ligules and its leaf morphology is closer to that of *S. leptocarpus* DC. rather than the two remaining varieties of *S. pectinatus*.

This paper concludes with a key to all radiate species of *Senecio* in Australia. Two of the terminal taxa in the key are complexes, the Australian lautusoid complex (including *S. pinnatifolius* A.Rich., *S. spathulatus* A.Rich. and *S. capillifolius* Hook.f.) and the *S. glossanthus* (Sond.) Belcher complex. Taxonomic studies have recently been carried out on these complexes (Thompson, two papers in press). Forms of the lautusoid complex are sympatric with and have occasionally been confused with the annual members of the Magnificus group.

Materials and Methods

Herbarium specimens from AD, BRI, CANB, DNA, HO, MEL, NE, NSW, and PERTH were examined. The circumscriptions of, and morphological variation within, previously recognised taxa was critically assessed and new taxonomic concepts developed and tested. Distribution maps were generated using ArcView computer program.

Terminology for descriptions and keys:

Unit inflorescence here refers to the cluster of capitula at the end of primary stems and branches where all the supporting inflorescence branches are leafless.

The diameter of the involucre is based on unpressed specimens measured approximately mid-involucre.

Divided, of leaves: Leaves with sinuses extending 50% or more towards the midrib are regarded here as divided and may be lobed (50–75%) or pinnatisect (> 75%). Undivided leaves have sinuses extending < 50% towards midrib and their margins are described as entire, denticulate, dentate or coarse-dentate.

Lageniform (of achenes): bottle-shaped, i.e. with the distal third much narrower than the proximal third.

Bands and lines of papillose hairs on achenes: These bands run longitudinally.

Part 1: Taxonomy of the Magnificus Group

Annuals, perennial herbs or shrubs, nearly glabrous or with scattered long hairs, often glaucous. *Leaves* thin to fleshy, divided or not; margin dentate or entire. *Unit inflorescences* of 1–20, rarely to c. 60; peduncles sometimes dilating gradually towards capitulum, finally 10–100 mm long. *Capitula* radiate; calycular bracteoles absent or 1–6, narrow-ovate to lanceolate, 1–5(–6) mm long, 0.3–1.0 mm wide; involucre cylindrical or campanulate, 4–16 mm long, 3–10 mm diam.; phyllaries 12–22, free or sometimes fused; stereome flat, glabrous or rarely with scattered hairs, with 1–3 generally inconspicuous resin ducts; outer phyllaries: scarious margin slender. *Florets* c. 30–80; ligulate florets (4–)6–12(–16), 5–30 mm long; corolla-limb shorter than, c. equal to, or longer than tube. *Achenes* homomorphic or nearly so, or ray achenes sometimes infertile and small, narrow-obloid, oblong-ellipsoid, or narrowly lageniform, 2.0–9.0 mm long, with ribs variously prominent, sometimes convex, papillose-hairy, with hairs short or long, or sometimes with granular papillae; diam. of carpopodium 1/3–1/2 of diam. of body. *Pappus* persistent or rarely caducous; bristles nearly smooth, scabrid-barbellate or barbellate, sometimes subplumose apically.

1. *Senecio gregorii* F.Muell., *Emun. Pl. Coll. Gregory* 7 (1859)

Othonna gregorii (F.Muell.) C.Jeffrey, *Kew Bull.* 41: 876 (1986).

Type: [South Australia], Coopers River [Creek], *A.C. Gregory*; holo: MEL.

Annuals to 0.3(–0.5) m high, glaucous, glabrous. *Mid-stem leaves* narrow-linear, to 10 cm long, with l:w ratio c. 15–20, undivided; margin entire; base narrow. *Upper-stem leaves* similar. *Unit inflorescences* of 1–5 capitula; peduncle dilating from c. 5 mm below base of capitulum. *Capitulum* ecalyculate; involucre 5–16 mm long, 3–9 mm diam. (size often highly variable on one plant); phyllaries c. 13, all ± seamlessly fused (except for apices) to adjacent phyllaries or a few with margins evident; involucre eventually splitting into 3 or 4 sections. *Florets* 30–55; ligulate florets 7–11; ligule 12–20 mm long, yellow, with 4–6 veins; disc florets: corolla 7–10 mm long; limb shorter than tube; balusterform base of corolla 3–5 mm long. *Achenes* dimorphic; disc achene narrow-obloid or slightly lageniform, 4–8.5 mm long, orange-brown or reddish, papillose hairs 0.6–1 mm long in bands, obscuring most of surface; ray achenes often not developing, pale, thin, with thin pappus bristles, otherwise similar to or slightly shorter and more densely hairy than disc achenes. *Pappus* persistent, 10–30 mm long; bristles smooth, robust proximally. (Figs 1 & 3)

Flowers most of year.

Distribution and Habitat: Occurs in western and south-western Western Australia from Carnarvon south-east to Kalgoorlie; in central Australia from Halls Crossing in southern Northern Territory south to the Whyalla area in southern South Australia and from Warburton in far eastern Western Australia east to Blackall in central Queensland. Also extends into south-eastern Australia as far as the Big Desert area in far north-western Victoria (Fig. 2a). Grows in various soils in river beds, plains, dunes and saline swamp margins, in herbfield, shrubland and woodland; commonly abundant following significant rains.

Notes: An unusual species with several apparently unique features, although it is similar to several other radiate Australian taxa of arid or semiarid regions. Also superficially similar to members of the southern African genus *Othonna*, in which it was placed in 1986. Closest affinity is with *S. conferruminatus* I.Thomps. based on involucre morphology. It possibly also has affinity to *S. gypsicola* based on fusion of phyllaries, and to *S. platylepis* based on achenial morphology. Readily recognised by the involucre of fused phyllaries, the absence of calyculate bracteoles, the large achenes with an indumentum of long hairs, and the very long, basally-stout pappus bristles. Style-branches are long and their apex has a crown of rather long clear narrow-triangular papillae. Capitulum size varies considerably on individuals with later-developing capitula often much smaller. This feature also occurs in *S. conferruminatus*.

Another similarity between *S. gregorii* and *S. conferruminatus*, and which distinguishes them from the other members of the Magnificus group, is the morphology of the corolla of disc florets. The limb is markedly shorter than the tube and the balusterform (flared) base of the tube is elongate. In contrast, the balusterform base is not elongate in other species, the limb in *S. magnificus* and *S. megaglossus* is longer than the tube, and in most other species it is c. as long as the tube. *Senecio gypsicola* is a slight exception in that the limb in this species is commonly slightly shorter than the tube.

Selected specimens examined: **WESTERN AUSTRALIA**: 35 miles [56 km] west of Docker River on road to Giles Weather Station, *K. Menkhorst s.n.*, 11.viii.1986 (MEL, PERTH). **NORTHERN TERRITORY**: 10 miles [16 km] WNW of Santa Teresa Mission, *M. Lazarides 5732*, 17.viii.1956 (CANB, DNA). **SOUTH AUSTRALIA**: Gairdner-Torrens district: 75 km N of Glendampo on Stuart Highway, E side of road, *J.R. Shelley 27 & R. McCullough*, 12.viii.1984 (AD, CBG, MEL, PERTH). **QUEENSLAND**: 5 km W of Betoota on Birdsville Road, *K.A. Williams 78171* (AD, BRI). **NEW SOUTH WALES**: 8.5 km southeast of Fort Grey campsite turnoff en

Figure 1. Achenes and pappus a. *S. gregorii* (*D.E. Symon 2164* PERTH); b. *S. conferruminatus* (holotype); c. *S. gypsicola* (holotype); d. *S. magnificus* (*B. Nordenstam & A. Anderberg 873* MEL), apex of pappus bristle also shown; e, l. *S. pilosiceristus* (*H.B. Williamson*, Sept. 1921 CANB), apex of pappus bristle also shown; f. *S. megaglossus* (*F.E. Davies 1377a & R.B. Hadlow* MEL; achene x 5 only); g. *S. velleioides* (*R.M. King 9788* MEL; h. *S. murrayanus* (*F. Mueller* 1878 MEL), details of granular hairs (x 50) also shown; i. *S. tuberculatus* (*S.L. Everist 6235* BRI), details of granular hairs (x 50) also shown; j. *S. platylepis* (*J.H. Browne 164* MEL). Achene x 5, achene with persistent pappus x 1, pappus bristle x 50 (viewed in proximal third; also at apex in e and f).

Figure 2. Distribution of a. *S gregorii*; b. *S. conferruminatus*; c. *S. gypsicola*; d. *S. magnificus*; e. *S. pilosicristus*; f. *S. megaglossus.*

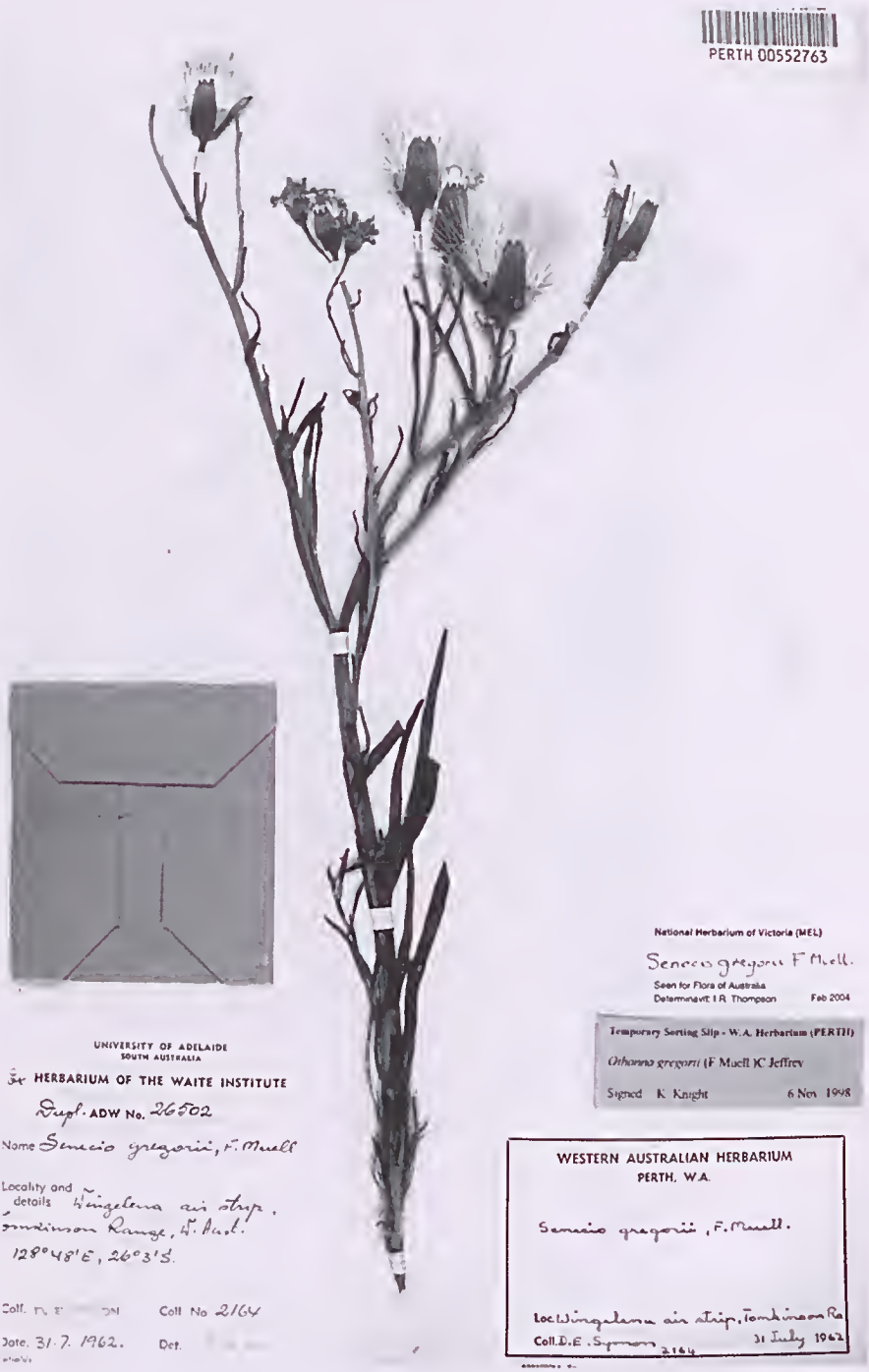
PERTH 00552763
National Herbarium of Victoria (MEL)
Senecio gregorii F Muell.
Seen for Flora of Australia
Determinavit I.R. Thompson Feb 2004
Temporary Sorting Slip - W.A. Herbarium (PERTH)
Othonna gregorii (F Muell) C Jeffrey
Signed K. Knight 6 Nov 1998
UNIVERSITY OF ADELAIDE
SOUTH AUSTRALIA
HERBARIUM OF THE WAITE INSTITUTE
Dupl. ADW No. 26502
Name Senecio gregorii, F. Muell
Locality and details Wingelina air strip, Tomkinson Range, W. Aust.
128°48'E, 26°3'S.
Coll. D.E. SYMON Coll No 2164
Date. 31.7.1962. Det.
WESTERN AUSTRALIAN HERBARIUM
PERTH, W.A.
Senecio gregorii, F. Muell.
loc. Wingelina air strip, Tomkinson Ra
Coll. D.E. Symon 2164 31 July 1962

Figure 3. *S. gregorii* (*D.E. Symon 2164* PERTH).

route to Tibooburra in Sturt National Park, *R.G. Coveny 13498, M. Savio & B. Wiecek*, 4.ix.1989 (AD, BRI, CANB, MEL, NSW). **VICTORIA**: Wyperfeld Nat. Park - 400 m south of Meridian Gate, *D.C. Cheal*, 24.viii.1983 (MEL).

2. *Senecio conferruminatus* I.Thomps., ***sp. nov.***

A S. *gregorii* F.Muell. capitulis pluribus, flosculis paucioribus, ligulis paucioribus, acheniis longioribus pilis brevioribus, pappa breviore differt.

Type: Western Australia, 13 miles East of 550 mile peg, North West Highway, *T.E.H. Aplin 3220*, 3 July 1970; holo: PERTH.

Annuals to c. 0.3m high, glaucous, glabrous. *Mid-stem leaves* narrow-linear, to 10 cm long, with l:w ratio c. 15–30, undivided; margin entire; base narrow. *Upper-stem leaves* similar. *Unit inflorescences* of 2–7 capitula; peduncle dilating from 1–5 mm below base of capitulum or hardly dilating. *Capitula* ecalyculate; involucre cylindrical, 4–15 mm long, 2–4 mm diam. (length commonly highly variable on one plant); phyllaries c. 13, all ± seamlessly fused (except for apices) to adjacent phyllaries or a few with margins evident; involucre eventually splitting into 3 or 4 sections. *Florets* 20–32; ligulate florets 5–7, commonly 5; ligule 8–15 mm long, yellow, with 4–6 veins; disc florets: corolla 5–8 mm long; limb shorter than tube; balusterform base of corolla 1–3 mm long. *Achenes* narrowly lageniform, 6–10 mm long, brown or reddish, with papillose hairs c. 0.3 mm long in bands, obscuring c. 50% of surface; l:w ratio of hairs c. 6. *Pappus* persistent, 5–17 mm long; bristles nearly smooth. (Figs 1 & 4)

Flowers late winter–spring.

Distribution and Habitat: Occurs in far western Western Australia from the Gascoyne River near Carnarvon S to the Murchison River (Fig. 2b). Grows in various soils in river beds, plains, dunes and saline swamp margins, in herbfield, shrubland and woodland.

Notes: This species is very similar to *S. gregorii* in terms of the texture and nature of the fusion of phyllaries, but the capitula of *S. conferruminatus* are generally more numerous, smaller and with fewer florets. Furthermore, ligulate florets are fewer, achenes are longer particularly relative to the length of the involucre (c. 2/5–3/4 of length compared to c. 1/2 of length in *S. gregorii*), achenial hairs are much shorter, and the pappus bristles are generally shorter and less robust. The narrowly lageniform achenes are reminiscent of *S. tuberculatus* and *S. murrayanus* but those of the latter two species are clothed in papillae rather than hairs.

Etymology: The epithet alludes to the fused phyllaries of the involucre (L. *conferruminatus*, fused)

Selected specimens examined: **WESTERN AUSTRALIA**: Wooramel Roadhouse, *N.S. Lander 1340, B.A. Fuhrer, & P.S. Short*, 17.viii.1986 (MEL, PERTH); 16 km west of Gascoyne junction, *P.S. Short 2517, N.S. Lander & B.A. Fuhrer*, 20.viii.1986 (AD, MEL, PERTH); 150 mi [250 km] N of Mullewa, *B.L. Turner 5371*, 21.viii.1965 (MEL); Outside Carnarvon towards Geraldton, *D. Clyne 153* (NSW).

3. *Senecio gypsicola* (R.Bates) I.Thomps., ***comb. nov.***

Othonna gypsicola R.Bates, *J. Adelaide. Bot. Gard.* 15: 149 (1993).

Type: South Australia, gypseous clay mounds between Copper Hills and Arckaringa, *R. Bates 19171*, 8 July 1989; holo: AD; iso: NSW, PERTH.

Annuals to c. 0.3 m high, glabrous, sometimes glaucous. *Mid-stem leaves* narrow-obovate to oblanceolate, to 4 cm long, with l:w ratio c. 3–4, undivided; margin entire; tapering to

Figure 4. *S. conferruminatus* (holotype: *T.E.H. Aplin 3220* PERTH).

a moderately narrow base. *Upper-stem leaves* similar. *Unit inflorescences* of 1–4 capitula; peduncle sometimes dilating from c. 5 mm below base of capitulum. *Capitulum* ecalyculate; involucre cylindric, 6–9 mm long, 2–4 mm in diam.; phyllaries c. 12, but often fused as pairs resulting in 5–10 sections, these sections shortly fused basally. *Florets* c. 60; ligulate florets 8–10; ligule c. 10 mm long, yellow, with 4–6 veins; disc florets: corolla c. 4–6 mm long; limb shorter than or c. equal to tube; balusterform base of corolla c. 1 mm long. *Achenes* 5–8 mm long, brown, with papillose hairs c. 0.3 mm long in bands; obscuring c. 40% of surface. *Pappus* persistent, 5–6 mm long; bristles minutely scabrid, length of barbels c. equal to diam. of bristle. (Fig. 1)

Flowers winter.

Distribution and Habitat: Occurs in north-central South Australia in the Coober Pedy area and further north at Arckaringa (Fig. 2c). Grows on mounds of black gypseous clay in ephemeral herbfields.

Notes: Collected from only two areas, initially in 1989 about 2 months after heavy rains when it appeared in large numbers. Resembles *S. gregorii* in that there is some fusion of phyllaries, but is closer to *S. magnificus* and *S. megaglossus* in leaf, capitular and achenial morphology.

Selected specimens examined: **SOUTH AUSTRALIA**: Dam on Copper Hills and Arckaringa Station, *R. Bates 19816*, 7.vii.1989 (AD); 30 km NE of Coober Pedy on the road to Oodnadatta, *D.E. Symon 16196 & J. Symon*, 30.vi.2000 (AD, CANB, MEL); 16 km NE of Coober Pedy. Coober Pedy–Oodnadatta Road at the crossing of the Oogelima Creek on Moon Plain, *D.E. Symon 16161 & J. Symon*, 30.vi.2000 (AD, BRI, CANB, MEL); Giddi Giddina Creek, 46 km NE of Coober Pedy on road to Oodnadatta, *D.E. Symon 15664 & J. Symon*, 30.iv.1997 (AD, CANB).

4. *Senecio magnificus* F.Muell., *Linnaea* 25: 418 (1852)

Type: [South Australia], 'In glarea exsiccata rivi Cudnaka [Kanyaka River in Flinders Ras]', *F. Mueller*; lecto (**here selected**): MEL 304729; isolecto: MEL 82167.

Shrubs to c. 1.3 m high, glaucous, glabrous. *Mid-stem leaves* oblong, oblong-obovate, oblanceolate, or narrow-elliptic, to 11 cm long, with l:w ratio c. 2–4, undivided; margin entire, dentate, coarse-dentate or serrate, teeth several, more numerous distally; base ± attenuate to truncate, often decurrent. *Upper-stem leaves*: base often cordate and semiamplexicaul. *Unit inflorescences* of 3–10(–20) capitula; peduncles usually dilating from c. 10–20 mm below base of capitulum. *Capitula*: calycular bracteoles (0–)1–3, 1–6 mm long; involucre campanulate, 6–11 mm long, c. 4–7 mm diam.; phyllaries 12–18. *Florets* c. 30–55; ligulate florets 4–8; ligule 7–20 mm long, yellow, with 4–13veins; disc florets: corolla 7–12 mm long; limb longer than tube; balusterform base of corolla 0.5–0.8 mm long. *Achenes* oblong-ellipsoid, 3.0–7.0 mm long, with papillose hairs c. 0.3 mm long in bands or ±evenly distributed, largely obscuring surface. *Pappus* persistent, 6–12 mm long; bristles barbellate to subplumose apically, length of barbels 2–3 times diam. of bristle, otherwise bristles minutely scabrid, length of barbels c. equal to diam. of bristle. (Figs 1 & 5)

Flowers mostly winter and spring.

Distribution and habitat: Occurs in western Western Australia from Exmouth in the far central-west south-east to the Kalgoorlie area, and in Central Australia from the Barrow Creek area south-east to Wilcannia in central-western New South Wales, south-south-east to Ucolta in central-eastern South Australia, and south-west to the Blackstone Range in far central-eastern Western Australia. Also occurs disjunctly in central Queensland (Fig. 2d). Grows in sand and sandy loam soils, on plains or sometimes in rocky sites, over limestone and dolerite, often associated with watercourses, in spinifex grassland, shrubland, and low open woodland.

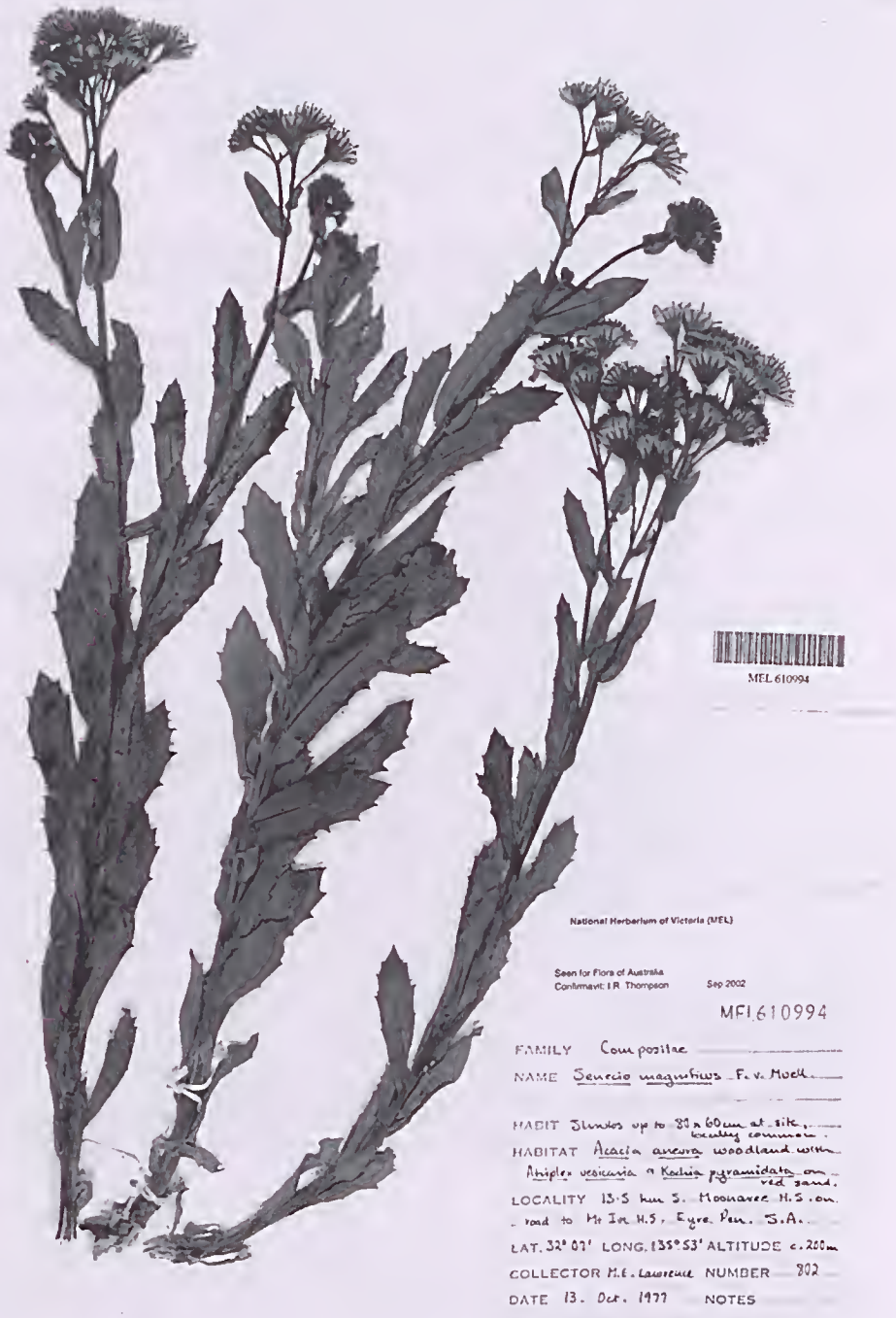
MEL 610994
National Herbarium of Victoria (MEL)
Seen for Flora of Australia
Confirmavit: I R Thompson
Sep 2002
MEL 610994
FAMILY Compositae
NAME Senecio magnificus F. v. Muell.
HABIT Shrubs up to 80 x 60 cm at site, locally common.
HABITAT Acacia aneura woodland with Atriplex vesicaria & Kochia pyramidata on red sand.
LOCALITY 13·5 km S. Moonaree H.S. on road to Mt Ive H.S., Eyre Pen. S.A.
LAT. 32° 07' LONG. 135° 53' ALTITUDE c. 200m
COLLECTOR M.E. Lawrence NUMBER 802
DATE 13. Oct. 1977 NOTES

Figure 5. *S. magnificus* (*M.E. Lawrence 802* MEL).

Notes: The pappus bristles of *S. magnificus* are more densely and longer barbellate distally than in other Australian species of *Senecio*, although *S. megaglossus* is similar. Populations in north-western Western Australia tend to have more entire leaves with a higher length:width ratio and have relatively long bracteoles; they may warrant further investigation.

Selected specimens examined: **WESTERN AUSTRALIA**: About 40 km E of Hamersley Station Homestead, *A.A. Mitchell PRP714*, 7.ix.1995 (MEL, PERTH); 15 km E of Glenorn on Mt Remarkable Rd, *A.A. Mitchell 2720*, 28.viii.1992 (CANB, PERTH). **NORTHERN TERRITORY**: Between Red Bank Gorge and Glen Helen–Haasts Bluff Road, *G.W. Carr 1672 & A.C. Beauglehole 45451*, 12.vi.1974 (AD, CANB, DNA, MEL); 5 miles SSE of Undoolya Station, *M. Lazarides 5716*, 16.viii.1956 (BRI, CANB). **SOUTH AUSTRALIA**: On way from Wilpena Pound to Braehina Gorge, *V. Jaegermann*, 27.viii.1983 (AD, MEL). **QUEENSLAND**: Gregory North, Warlus VI, Site R5, 23 km W of 'Cork', *R.W. Purdie 1022*, 7.ix.1977 (BRI). **NEW SOUTH WALES**: c. 100 km by road from Broken Hill towards Mootwingee National Park, c. 10 km direct NE of The Bluff, *A.M. Lyne 1858 & S. Donaldson*, 11.xii.1995 (CBG, MEL, NSW).

5. *Senecio pilosicristus* I.Thomps., ***sp. nov.***

A *S. magnifico* Desf. ex Poir. foliis superioribus valde lanceolatis, bracteolis calyculorum multioribus, acheniis valde costatis papillis ad limitatas costae differt; a *S. velleioides* A.Cunn. ex DC. bracteolis calyculorum multioribus, acheniis magnioribus differt.

Type: South Australia, 5 m [8 km] N of Wirra (19 m [33 km] N of Lameroo) by roadside, *D.E. Symon 3878*, 12 Oct. 1965; holo: AD; iso: AD (two sheets).

Perennial herbs to c. 0.8 m high, with secondary roots fleshy, sometimes weakly glaucous, glabrous. *Leaves* in lower stem region somewhat larger and more crowded; narrow-obovate to oblanceolate, to 17 cm long, dentate to lobate in distal half. *Mid-stem leaves* narrow-elliptic to lanceolate to 12 cm long, 40 mm wide, with l:w ratio c. 2.5–8, undivided; margin coarsely dentate distally or almost entire; base cuneate to cordate, not or moderately amplexicaul. *Upper-stem leaves* becoming strongly triangular-lanceolate; margin entire; base moderately amplexicaul. *Unit inflorescences* of 2–8(–15) capitula; peduncle dilating from 1–8 mm below base of capitulum. *Capitula*: calycular bracteoles 3–6, 2–4 mm long; involucre campanulate, 6–10 mm long, c. 5–7 mm diam.; phyllaries 12–16. *Florets* 30–55; ligulate florets 6–10; ligule 10–20 mm long, yellow, with 4 or 5 veins; disc florets: corolla 5–8 mm long; limb equal to or slightly longer than tube; balusterform base of corolla 0.4–0.8 mm long. *Achenes* narrow-obloid, 4–5 mm long, brown, with pairs of ribs strongly raised to form several ridges, with papillose hairs c. 0.3 mm long restricted to lines within ridges. *Pappus* persistent, 5.5–7 mm long; bristles minutely scabrid or nearly smooth, length of barbels less than diam. of bristle. (Figs 1 & 6)

Flowers late winter–spring.

Distribution and Habitat: Occurs in south-eastern Australia from Kangaroo Island in south-eastern South Australia ESE to the Grampians in western Victoria and ENE to Manangatang in north-western Victoria (Fig. 2e). Grows on plains and sand hills, in woodland and low woodland, and recorded once from a swamp on Kangaroo Island.

Etymology: The epithet alludes to the papillose hairs arising from the prominent ridges of the achenes (L. *pilosus*, hairy; and *cristus*, ridge).

Notes: *Senecio pilosicristus* has previously been identified as *S. magnificus* or occasionally as *S. velleioides*, and morphologically it is somewhat intermediate between these two species. The three species are geographically isolated from one another. *Senecio pilosicristus* differs from *S. magnificus* by being non-shrubby, having broader and more numerous calycular bracteoles, peduncles that do not gradually dilate towards

HOLOTYPE
FLORA OF AUSTRALIA PROJECT
Senecio pilosicristus I.Thomps.
Det Ian Thompson Date 15 v 2003
Senecio magnificus F.Muell.
Det. Meuzies A.A. 17.i. 1978
Dupl K SPN MSC AD Som
UNIVERSITY OF ADELAIDE
SOUTH AUSTRALIA
& HERBARIUM OF THE WAITE INSTITUTE
Dupl. ADW No. 31066
Name Senecio ? blattylepis DC
Locality and details 5m N. of Yirrkalla (19m. N.E. Gamerro) by roadside, 5th Inst.
3878
LOAN 4/02
Coll. D.E. SYMON Coll. No. 3878
Date 12.10.1965. Det

Figure 6. *S. pilosicristus* (holotype: *D.E. Symon 3878* AD).

the capitulum, pappus bristles that are less conspicuously barbellate, basal leaves that are narrow oblanceolate, upper-stem leaves that are triangular-lanceolate and with a more acute apex, inflorescences that are less congested and of fewer capitula, ligules that are consistently only 4- or 5-nerved, and achenes that have strongly raised ribs with longer hairs along ridges (in shallow grooves along ridge top) and glabrous between ribs. The fruit is similar to that of *S. velleioides* but is much larger and with longer hairs along the ridges. The habit and morphology of the upper-stem leaves are also reminiscent of *S. velleioides*. Further investigation of the underground parts of the plant is desirable, particularly to ascertain whether the plant is rhizomatous.

Selected specimens examined: **SOUTH AUSTRALIA**: Monarto South, School, *Herb. Ising*, Oct. 1929 (AD); Monarto South, *M. Kenny s.n.*, 26.ix.1963 (AD); Murray Bridge, *R. Bates 3763*, 24.vi.1984 (AD); Karoonda, *J.M. Black*, 6.x.1915 (AD); Pinnaroo, *J.M. Black*, 5.ix.1912 (AD); Hundred of Senior, ca. 20 km north-north-east of Bordertown, *D. Hunt 1124*, 8.ix.1962 (AD); Coonalpyn, *D. of A.* 433, 15.iv.1965 (AD); Alawoona, ca. 30 km south of Loxton, School, *Herb Ising*, Sept. 1936 (AD); Wilkawatt, *T.G.B. Osborn*, Oct. 1913 (AD); Wynarka, School, *Herb Ising*, Oct. 1932 (AD); Kangaroo Island, Breakneck River, *J.B. Cleland*, 19.xi.1924 (AD). **VICTORIA**: Mt Stapylton, northern Grampians, *P. Collier 2942*, 4.x.1987 (HO); Jeparit, St. *E. D'Alton*, Jan. 1902 (NSW); Parilla forest, *W. Gill*, Jan. 1911 (NSW); Coonalpyn, 90 mile desert, *B. Cleland*, May 1911 (NSW); Manangatang, *H.B. Williamson*, Sept 1921 (CANB); Sunset Country - central-west, near main east-west track, *P.D. Cheal*, 9.x.1978 (MEL); Big Desert, 12 km S of Murrayville on Nhill Road, *M.G. Corrick 6255 & B.A. Fuhrer*, 29.viii.1979 (MEL); Fyans Creek upstream from Stawell Pipeline, approx. 3/4 mile [1.2 km] up from bridge on Grampians Road, *A.C. Beauglehole 24907*, 29.ii.1968 (MEL); Dimboola, *F.M. Reader*, 29.ix.1882 (MEL); Big Desert, adjoining South Australian border fence, in Toonamool Parish ± 12 miles [19 km] north of Serviceton, *J.H. Willis*, 17.ix.1948 (MEL).

6. *S. megaglossus* F.Muell., *Linnaea* 25: 419 (1852)

Type: [South Australia]. 'In collibus aridis pone fodinas Burra, inter rupes ad Broughton-flumen et inter rivos Hutt et Hill' [On arid hills at the Burra mine, also on rocks at the Broughton between the Hutt and Hill rivers], *F. Mueller*, Oct. 1851; lecto (**here selected**): MEL 304730; isolecto: MEL.

Shrubs to c. 0.8 m high, glaucous, glabrous. *Mid-stem leaves* narrow-obovate to oblanceolate or narrow-elliptic, to 10 cm long, with l:w ratio c. 2–4, undivided; margin entire or dentate; base tapering, hardly amplexicaul. *Upper-stem leaves* similar. *Unit inflorescences* of 1–4 capitula; peduncle dilating from c. 10–20 mm below base of capitulum. *Capitula*: calycular bracteoles (0–)1–3, 1–5 mm long; involucre campanulate, 8–15 mm long, c. 8–10 mm in diam.; phyllaries 16–20. *Florets* 60–80; ligulate *florets* 8; ligule 15–30 mm long, yellow, with c. 12–20 veins; disc florets: corolla 9–15 mm long; limb longer than tube; balusterform base of corolla c. 1 mm long. *Achenes* narrow-obloid, 5–7.5 mm long, brown, with ribs moderately raised especially basally, ±glabrous or with scattered papillose hairs c. 0.3 mm long obscuring up to half of surface. *Pappus* persistent, 8–10 mm long; bristles conspicuously barbellate around summit, length of barbels 2–3 times diam. of bristle, more proximally, bristles minutely scabrid, length of barbels c. equal to diam. of bristle. (Fig. 1)

Flowers winter–spring.

Distribution and habitat: Occurs in south-eastern South Australia from the Flinders Ranges south-south-east to the Lofty Ranges (Fig. 2f). Grows in sandhills and in rocky gorges in or above creeks in loam and red clay.

Notes: Similar to *S. magnificus* but with fewer and larger capitula per inflorescence, ligules with more numerous veins, and achenes less densely indumented. Sympatric with and possibly occasionally hybridises with *S. magnificus* (Quorn area). *Senecio*

megaglossus and *S. magnificus* are also similar in that the peduncles of these species begin to dilate a greater distance below the base of the capitulum compared to those of related species.

Selected specimens examined: **SOUTH AUSTRALIA**: South Mount Lofty Ranges, Marne River Gorge, *F.E. Davies 1377a & R.B. Hadlow*, 21.xi.1989 (CBG, MEL); Warren Gorge, 21 km N of Quorn, Flinders Ranges, *A.J.A. Sikkes AS647 & P. Ollerenshaw*, 21.ix.1973 (CBG).

7. *Senecio velleioides* A.Cunn. ex DC., *Prodr.* 6: 374 (1838)

Type: [New South Wales] 'in collibus rupestribus ad septentr. urbis Bathurst in Nova-Hollandia, *A.Cunningham*; holo: G, *n.v.*, microfiche seen MEL.

Perennial herbs to c. 2 m high, usually glaucous, glabrous. *Mid-stem leaves* narrow-elliptic to narrow-oblong, to 20 cm long, with l:w ratio c. 2–4, undivided; margin entire or dentate; base strongly cordate and amplexicaul. *Upper-stem leaves* lanceolate, strongly amplexicaul. *Unit inflorescences* of 5–80 capitula; peduncle dilating from c. 3–5 mm below base of capitulum. *Capitula*: calycular bracteoles 0–4, 1.0–3.0 mm long; involucre campanulate, 5.0–7.0 mm long, c. 3–5 mm diam.; phyllaries 12–16. *Florets* 35–50; ligulate florets 6–9; ligule 8–15 mm long, yellow, with 4 or 5 veins 4; disc florets: corolla 5–6 mm long; limb c. as long as tube; balusterform base of corolla c. 0.5 mm long. *Achenes* obloid to narrow-obloid, 2–4 mm long, brown, with pairs of ribs strongly raised to form several ridges, glabrous, or with papillose hairs c. 0.3 mm long in grooves of ridges. *Pappus* caducous, 3–5 mm long; bristles minutely scabrid, length of barbels less than diam. of bristle. (Fig. 1.)

Flowers spring–autumn

Distribution and habitat: Occurs in far south-eastern Australia from Wingen Maid near Taree in north-eastern New South Wales south-south-west to the Otway Ranges in south-western Victoria, and widely distributed in Tasmania (Fig. 7a). Grows in loamy soils in woodland and forest.

Notes: Distinguishable from sympatric species of *Senecio* by the strongly amplexicaul, glaucous leaves, the paucity of calycular bracteoles, and the relatively small deeply-ribbed achenes with hairs in grooves along the summit of prominent ribs. Tasmanian forms appear to be more robust, are less glaucous, have inflorescences with a greater number of heads, and calycular bracteoles that are a little longer and slightly more numerous. *Senecio velleioides* is similar vegetatively and in achenial morphology to *S. pilosicristus* but reproductive structures are more numerous and smaller, calycular bracteoles are fewer, and the achenes are much smaller and have caducous pappus bristles.

Selected specimens examined: **NEW SOUTH WALES**: 5.1 km NE along Galah Mtn Rd, then 1.6 km ± SE along trail to Rocky Ck, near Newnes, *P.D. Hind 5971 & W. Cherry*, 31.i.1990 (AD, HO, MEL, NSW); Carters Creek, Currowan State Forest, NW of Bateman's Bay, South Coast, *R. Pullen 8730 & J. Story* 6.xii.1973 (CANB, BRI); Summit of Mt Imlay, *D.E. Albrecht 194 & B.J. Conn*, 21.ii.1983 (AD, MEL, NSW, PERTH). **VICTORIA**: 19 km SW of Colac PO, *A.C. Beauglehole 67298*, 13.xii.1979 (MEL). **TASMANIA**: Pine Cove Creek, *A. Moscal 5393* (AD, HO); Taranna, *W. Ashby & D.P.I.*, 24.ii.1995 (AD, HO, MEL, NSW).

8. *Senecio murrayanus* Wawra, in H. Wawra von Fernsee & G.R. von M. Beck, *Itin. Princ. S-Coburgi* 2: 48 (1888)

Type: [Victoria], 'Austral. Victoria/Murray Fl., [Murray River], *Dr Wawra 427*; holo: W *n.v.*, *fide* R.O. Belcher, *Muelleria* 6: 176 (1986); probable iso: MEL.

Annuals to c. 0. 5 m high, not glaucous, ± glabrous. *Mid-stem leaves* very narrow-elliptic to linear, to 10 cm long, with l:w ratio c. 7–12, lobate; lobes up to 3 per side; margins

entire; base narrow, not amplexicaul. *Upper-stem leaves* similar. *Unit inflorescences* of 3–10(–20) capitula; pedunele dilating from c. 2–5 mm below base of capitulum. *Capitula*: ealycular bracteoles 2–4, 2.0–5.0 mm long; involucre campanulate, 4.0–7.0 mm long. c. 6–10 mm diam.; phyllaries 14–22. *Florets* 50–70; ligulate florets c. 8; ligule 5–10 mm long, yellow, with 4 veins; dise florets: corolla 4–7 mm long; limb c. as long as tube; balusterform base of corolla e. 0.5 mm long. *Achenes* narrowly lageniform, 5–7 mm long, ellipsoid granule-like, usually opaque papillae erowded over entire surface. *Pappus* persistent, 4–7 mm long; bristles minutely seabrid, length of barbels c. equal to diam. of bristle. (Fig. 1.)

Flowers mostly winter–spring.

Distributiou aud Habitat: Oeeurs in south-eastern Australia from Trangie in eentral New South Wales south-south-west to Pine Plains in north-western Victoria (Fig. 7b). Eeologieal preferenees unknown, probably growing on clay or loam soils.

Notes: A rare species for which there are no recent records and which, although deseribed in 1888, was not recognised in Australia until 1986. Previous collections were left undetermined or identified as *S. lautus* Forst.f. ex Willd. or *S. platylepis*. Beleher matehed achenes from type material of *S. uurrayauus* with those of type material of the allied species *S. tuberculatus* which itself had only been deseribed in 1965. He eonsidered that the achenes were identieal and henee *S. tuberculatus* was sunk under the earlier name *S. uurrayauus*. The achenes are not in faet identieal and further differences between the two species are outlined under *S. tuberculatus*.

Figure 7. Distribution of a. *S. velleioides*; b. *S. murrayanus*; c. *S. tuberculatus*; d. *S. platylepis*.

The unusual ellipsoid to obovoid granular papillae covering the surfaee of the achenes of *S. murrayanus* have a longitudinal furrow. When water is applied, hair-like struetures are released and the water is absorbed to produee large amounts of mucus. This phenomenon is diseussed in more detail by Beleher (1986) and the similar, or identieal, meehanism that oeeurs in the more typieal papillose hairs is deseribed by Lawrenee (1985).

Selected specimens examined: **NEW SOUTH WALES**: Lachlan R., *F. Mueller*, Sept. 1878 (MEL); Trangie, *L.R. Clark*, 27.x.1942 (CANB); 30 miles NW of Balranald, *J.H. Leigh W311* (NSW). **VICTORIA**: Kerang, *J. Minchin*, Oct 1887 (MEL).

9. *Senecio tuberculatus* Ali, *Kew Bull.* 19: 423 (1965)

Type: Queensland, South of Tara, Bulloek Head Creek Road, *R.W. Johnson 538*, 28 Aug. 1958; holo: BRI; iso: NSW.

Annuals to e. 0.5 m high, not glaueous, with hairs sparse. *Mid-stem leaves* elliptie in outline, to 15 em long, with l:w ratio e. 1.5–3, pinnatiseet or bipinnatiseet; segments 2–5 per side; margins entire, dentate, or divided; base narrow. *Upper-stem leaves* similar. *Unit inflorescences* of 3–30 eapitula; pedunele dilating from e. 2–5 mm below base of eapitulum. *Capitula*: ealyeular braeteoles 2–6, 1–3 mm long; involuere (3–)4–6 mm long, e. 6–10 mm diam., sparsely hairy; phyllaries 14–22. *Florets* 60–90; ligulate florets 8–12; ligule 5–10 mm long, yellow, with mostly 4 or 5 veins; dise florets: eorolla 4–6 mm long; limb e. as long as tube; balusterform base of eorolla e. 0.5 mm long. *Aehenes* narrowly lageniform, 4–7 mm long, orange-brown, with ± translueent granule-like papillae seattered to moderately dense over surfaee, sparser on neek,. *Pappus* persistent, 4–5 mm long; bristles minutely seabrid, length of barbels less than diam. of bristle (Figs 1 & 8) *Flowers* winter–spring.

Distribution and Habitat: Oeeurs in eentral-eastern Australia from Charleville in south-eentral Queensland S to Nevertire in north-eentral New South Wales, and east-south-east to Inglewood in far south-eastern Queensland (Fig. 7c). Grows in sandy-loam, loam and heavy grey elays in grassland, herbfield and Brigalow or Casuarina woodland.

Notes: Similar to the more southerly distributed *S. murrayanus* but differing by having leaves more deeply disseeted, phyllaries shorter, and bearing seattered eoarse hairs at anthesis, and aehenes more sparsely eovered, especially on neck, by smaller, differently shaped, translueent granular papillae.

Selected specimens examined: **QUEENSLAND**: 7 km north of Barringun along main road to Cunnamulla, *P.S. Short 3569*, 15.viii.1989 (BRI, MEL); 10 km W of Condamine River on Moonie Highway, 16 km SW of Dalby, *J. Gillieatt 192*, 21.ix.1964 (BRI); Near Donga Creek, 45 miles N of St George, on Surat Road, *S.L. Everist 6235*, 4.ix.1960 (BRI). **NEW SOUTH WALES**: "Mt Mulyah" - about 80 km north-west of Louth, *C.W.E. Moore 7879*, 18.ix.1978 (CANB).

10. *Senecio platylepis* DC., *Prodr.* 6: 371 (1838)

Type: [New South Wales], 'in demissis ad basin montium Peels range [base of Coeoparra Range], *A. Cunningham*, [1817]; holo: G *n.v.*, mierofiehe seen MEL; iso: K *n.v.*, photo seen MEL.

Annuals to e. 0.3 m high, not glaucous, with hairs sparse or seattered. *Mid-stem leaves* very narrow-elliptie to very narrow-oblong in outline, to 12 em long, with l:w ratio e. 2–4, lobate to pinnatisect; segments 2–4 per side; margin often dentate to lobate; base often somewhat dilated, semi-amplexieaul. *Upper-stem leaves* similar. *Unit inflorescences* of 1–4 eapitula; pedunele dilating from e. 2–5 mm below base of eapitulum. *Capitula*: ealyeular braeteoles 3–6, 2.0–5.0 mm long; involuere eampanulate, e. 6–10 mm long, e. 7–10 mm diam., reeeptaele and pedunele sparsely to moderately hairy, glabreseent; phyllaries 12–20. *Florets* 40–70; ligulate florets 8–16; ligule 6–15 mm long, yellow, with

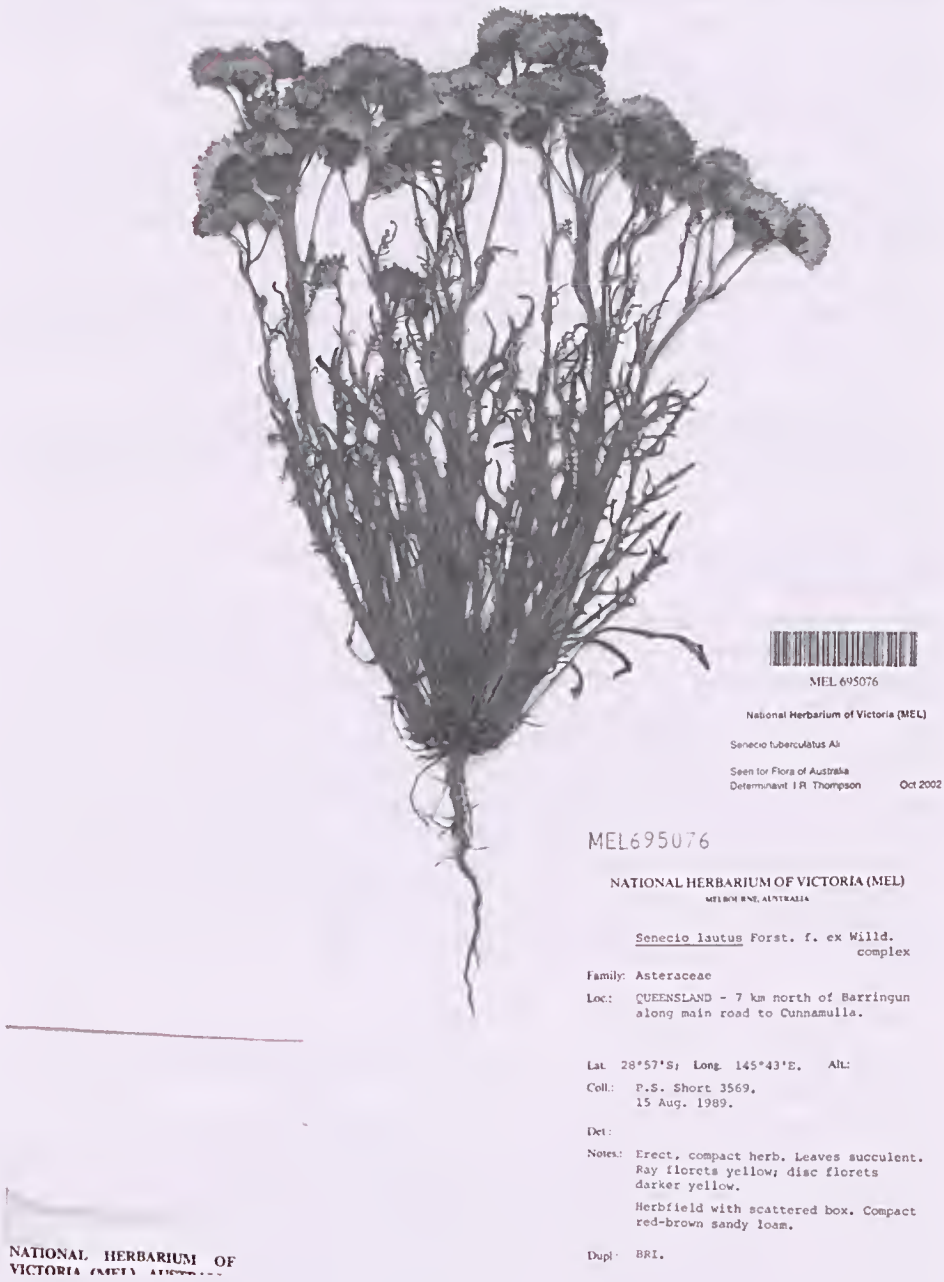
MEL 695076
National Herbarium of Victoria (MEL)
Senecio tuberculatus Ali
Seen for Flora of Australia
Determinavit I.R. Thompson Oct 2002
MEL695076
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Senecio lautus Forst. f. ex Willd. complex
Family: Asteraceae
Loc.: QUEENSLAND - 7 km north of Barringun along main road to Cunnamulla.
Lat. 28°57'S; Long. 145°43'E. Alt.:
Coll.: P.S. Short 3569, 15 Aug. 1989.
Det.:
Notes: Erect, compact herb. Leaves succulent. Ray florets yellow; disc florets darker yellow.
Herbfield with scattered box. Compact red-brown sandy loam.
Dupl.: BRI.
NATIONAL HERBARIUM OF

Figure 8. *S. tuberculatus* (*P.S. Short 3569* MEL).

4 or sometimes up to 8 veins; disc florets: corolla 5–7 mm long; limb c. as long as tube; balusterform base of corolla 0.5–0.8 mm long. *Achenes* of disc florets narrow-obloid, 4–6 mm long, with reddish exudate on surface, prominently ribbed, with papillose hairs c. 0.6–0.8 mm long, largely or totally obscuring surface; achenes of ray florets infertile, undeveloped, glabrous. *Pappus* persistent 5–8 mm long; bristles barbellate, length of barbels c. 2–3 times diam. of bristle. (Fig. 1)

Flowers mostly winter–spring.

Distribution and habitat: Occurs in western New South Wales and far north-western Victoria from the Bourke district south to Pink Lakes in Victoria (Fig. 7d). Grows in red sandy-loam or in clay in interdune flats or adjacent to ephemeral water in saltbush shrubland.

Notes: A species that occurs only in favourable years when it can form extensive colonies. Phyllaries are relatively broad and flat and achenes are unusual in having reddish glandular material covering the surface. This glandular material is overtopped and largely obscured by a dense indumentum of relatively long, white hairs.

Selected specimens examined: **NEW SOUTH WALES**: Yara via Condobolin, Yara Reserve, SW corner just outside fence, *K. Horne ANU4242*, 13.viii.1966 (CANB). **VICTORIA**: Birthday Tank ca. 4 miles (6 km) NW of Mt Crozier (ca. 90 km NW of Ouyen), *J.H. Willis*, 2.viii.1968 (MEL).

Part 2. Taxonomy of *Senecio pectinatus* DC. and the elevation of var. *oehroleucus* to the status of species.

Senecio pectinatus is one of a group of radiate species of alpine and subalpine regions that are rhizomatous, scapiform, with large, herbaceous calycular bracteoles, and glabrous achenes with a well-developed carpopodium. The group was recently revised by Belcher (1996). Other members of this group are *S. leptocarpus* DC., *S. papillosus* F.Muell. and *S. primulifolius* F.Muell. All taxa in the group are endemic to Tasmania except for *Senecio pectinatus* var. *major* (although there is an uncertain record of *S. pectinatus* var. *pectinatus* for Victoria). This group appear to be most closely allied to four mainland species based on similarities in capitulum size, calycular bracteole morphology and the size and glabrous nature of the achenes. These species are: *S. vagus* F.Muell., *S. macranthus* A.Rich., *S. amygdalifolius* F.Muell., and *S. daltonii* F.Muell. These species occur in forested hills and mountains of south-eastern Australia with the exception of *S. daltonii* which occurs in drier, lowland habitats.

11. *Senecio pectinatus* DC., *Prodr.* 6: 372 (1838).

Type: Tasmania, *R. Gunn 107*, 1832; holo: G *n.v.*, *fide* R.O. Belcher, *Muelleria* 9: 116 (1996), microfiche seen MEL.

Scapiform, rhizomatous perennials to 0.3 (–0.5) m high, ±glabrous except for upper scape and capitulum; roots fleshy. *Leaves* rosette-forming, narrow-spathulate, to 12 cm long, with l:w ratio c. 2–6, with expanded portion coarsely dentate to pinnatisect; major segments 3–5 per side, with shape various; commonly petiole-like in proximal third to two thirds. Stem leaves 5–12, usually similar to rosette leaves basally, becoming, entire upwards, grading into bracteoles. *Inflorescence* of a solitary capitulum or rarely 2. *Capitulum*: calycular bracteoles 6–10, 6–10 mm long; involucre campanulate, 6–11 mm long, 5–17 mm diam. (10–30 mm wide when pressed), ±glabrous; peduncle, base of capitulum and bracteoles hairy; phyllaries 12–30. *Florets* 60–120; ligulate florets 13–20; ligule 10–20 mm long, yellow, with 4(–6) veins; disc florets: corolla 4–9 mm long; limb longer than tube; balusterform base of corolla c. 0.5 mm long. *Achenes* very narrow-obloid or narrow-obconical, 4–8 mm long, orange-brown, glabrous; carpopodium well-developed. *Pappus* ?persistent, 4–7.5 mm long.

Flowers summer to early autumn

Distribution and Habitat: Occurs in south-eastern Australia including Tasmania. Grows in alpine or sub-alpine herbfields, heathland and shrubland, commonly near streams or seepage areas.

Notes: There are two varieties of this species differing only in their dimensions, and they are not always easy to distinguish, particularly if stunted plants are encountered. The key produced by Belcher (1996) when he described var. *major* does not adequately distinguish them. Although the variation appears almost continuous, I consider that the two varieties should be maintained. A modified key is presented below. The high chromosome number of 2n = 80 for var. *major* (Lawrence 1980) is suggestive of polyploidy. A chromosome count for the typical variety is lacking, however. The typical variety almost exclusively occurs in Tasmania, whereas var. *major* is largely confined to the mainland. In Tasmania, var. *major* appears to occur only in the north, e.g. in Ben Lomond National Park, where it is sympatric with the typical variety.

1 Scape < 1.5 mm diam.; rosette leaves 1–5(–8) cm long; involucre 6–8 mm long, usually < 15 mm wide when pressed; corolla of disc florets < 6 mm long ..... **11a.** var. ***pectinatus***

1: Scape > 1.5 mm diam.; rosette leaves 4–15 cm long; involucre 8–12 mm long, usually > 15 mm wide when pressed; corolla of disc florets > 6 mm long..... **11b.** var. ***major***

Figure 9. Distribution of a. *S. pectinatus* var. *pectinatus*; b. *S. pectinatus* var. *major*; c. *S. albogilvus*.

11a. *Senecio pectinatus* DC. var. ***pectinatus***

Distribution and Habitat: Occurs in Tasmania from Mt Arthur in the far north to Mt La Perouse in the far south. A specimen from Mt Buffalo in Victoria, *H.C.E. Stewart* (MEL) is doubtfully included as this variety. Further collections from this locality are desirable (Fig. 9a).

Selected specimens examined: **VICTORIA**: Mt Buffalo, *H.C.E. Stewart*, 27.i.1940 (MEL). **TASMANIA**: Hartz mountains National Park. Between Ladies Tarn and Hartz Peak, *P.S. Short 1892*, 1.ii.1983 (MEL); Ben Lomond National Park, Hamilton Crags, 1.5 km E of Legges Tor, *F.E. Davies* 1167, 23.i.1989 (AD, CBG, HO, MEL).

11b. *Senecio pectinatus* var. ***major*** F.Muell. ex Belcher, *Muelleria* 9: 120 (1996)

Type: [Victoria], Cobboras [Cobberas] Mountains, *F. Mueller*, [1854]; holo: MEL; syn: MEL.

Distribution and Habitat: Occurs in south-eastern Australia; on the mainland from Mt Kelly in southern parts of the Australian Capital Territory south-west to Mt Baw Baw in southern Victoria, and in north-eastern Tasmania at Hamilton Crags (Fig. 9b).

Selected specimens examined: **NEW SOUTH WALES**: Approx. 1 km along summit Rd from parking area, Mt Stillwell, Charlottes Pass, Koseius[z]ko, Koscius[z]ko National Park, *P. Hind 5520 & G. D'Aubert*, 1.iii.1988 (MEL, NSW). **VICTORIA**: Bogong High Plains near Mt McKay, beside road from "Ruined Castle", At head of ?McKay Creek, *M.G. Corrick 11500*, 30.i.1997 (CANB, MEL); Hotham Heights, Wall of Death, *D.E. Albrecht 4949*, 9.iv.1992 (MEL); Baw-Baws, *C.L. Gunn*, 31.i.1970 (CANB); Baw Baw National Park – Mt St Gwinear, *P.D. Cheal*, 11.i.1980 (MEL). **TASMANIA**: Ben Lomond National Park, Hamilton Crags, *M.G. Noble 28274*, 1.ii.1979 (HO).

12. *Senecio albogilvus* (F.Muell.) I.Thomps., *nom. nov.*

Senecio pectinatus var. *ochroleucus* F.Muell., *Papers & Proc. Roy. Soc. Tasmania for 1870*: 16 (1871), as var. *ochroleuca*; L.Rodway, *Tasm. Fl.* 93 (1903).

Type: [Tasmania], Mt Wellington, 4600 ft [1420 m], *F. Mueller*, Jan. 1869; lecto: MEL; syn: MEL.

Scapiform, rhizomatous perennials to 0.15(–0.25) m high, ±glabrous except for upper scape and capitulum; roots fleshy. *Leaves* rosetted, numerous, very narrow-oblanceolate to linear, to 4 cm long, with l:w ratio c. 8–15, entire except for 1 or 2 small serrations or lobes per side in distal half, sometimes ± entire; upper surface somewhat glossy, dark-green; lower surface much paler. Stem leaves 10–15, becoming entire, grading into bracteoles. *Inflorescence* of a solitary capitulum. *Capitulum*: calycular bracteoles 6–10, 4–9 mm long; involucre campanulate, 5–11 mm long, c. 3–7 mm diam., glabrous; peduncle and base of capitulum hairy; phyllaries 12–22. *Florets* 35–55; ligulate florets 10–15; ligule 8–12 mm long, cream-white, with 4(–6) veins; disc florets: corolla 4–6 mm long; limb longer than tube; balusterform base of corolla c. 0.5 mm long. *Achenes* narrow-obloid, 2–3 mm long, orange-brown, glabrous; carpopodium well-developed. *Pappus* ?persistent, 4.5–6 mm long.

Flowers summer to early autumn

Distribution and Habitat: Occurs in central-western and southern Tasmania from Cradle Mountain south to Pindar's Peak (Fig. 9c). Grows in rocky sites in herbfield, heathland and shrubland in montane to alpine regions.

Etymology: The epithet alludes to the colour of the ligules (*L.albus*, white and *gilvus*, pale yellow).

MEL 626694
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Senecio pectinatus DC.
Loc.: Tasmania. Hartz Mountains National Park. Between Ladies Tarn and Hartz Peak.
Lat. 43°14'30"S Long 146°46'E Alt. c.1080m
Coll.: P.S.Short 1892 1.ii.1983
Det.:
Notes: Perennial, stoloniferous herb. All florets yellow.
Growing in cushion plant community. Also commonly associated with Pentachondra pumila.
Includes wet collection 70% ethanol.
Senecio pectinatus var. pectinatus
Det. R.O.Belcher.
National Herbarium of Victoria (MEL)
Senecio pectinatus DC. var pectinatus
Seen for Flora of Australia
Determinavit: I.R. Thompson Apr 2003
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Figure 10. *S. pectinatus var. pectinatus* (*P.S. Short 1892* MEL).

National Herbarium of Victoria (MEL)
Senecio ochroleucus (F.Muell.) I.Thomps.
Seen for Flora of Australia
Determinavit: I.R. Thompson Apr 2003
MEL 627506
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
Senecio pectinatus DC.
var. ochroleuca Hodway
Loc Tasmania. c.4km SE. of Mt. Wellington summit.
Lat c.42°54'S Long 147°14'E Alt. c.1200m
Coll P.S.Short 1848 28.1.1985
Det
Notes Perennial, forming a spreading mat.
Ray florets white to cream, disc florets yellow.
Growing in wet areas with Glichenia and Astelia.
P S SHORT
1848

Figure 11. *S. albogilvus* (*P.S. Short 1848* MEL).

Notes: Previously included in *S. pectinatus* but distinct from this species in leaf morphology. The undivided, discolorous leaves are more reminiscent of those of *S. leptocarpus*, although considerably smaller. A further distinctive feature of this species is the white-cream colour of the ligules.

Selected specimens examined: **TASMANIA**: Cradle Mountain National Park, Eastern edge of Cradle Mountain c. 100 m below summit, *P.S. Short 1786*, 19.i.1983 (HO, MEL); c. 44 m SW of Mt Wellington summit, *P.S. Short 1848*, 28.i.1983 (MEL); Hartz Mountains National Park, Hartz Mountain track, 500 m from base of track, *F.E. Davies 878 & P. Ollerenshaw*, 15.i.1989 (AD, CBG, HO, MEL).

Key to radiate and quasiradiate *Senecio* and *Arrhenechthites* in Australia

Capitula in species in the following key are heterogamous with the majority of florets tubular and perfect and forming the disc except in *A. mixta*. In most cases the marginal pistillate florets are prominently ligulate, but there are a few species in which the pistillate florets have very small or undeveloped ligules. The latter can be distinguished from discoid species, e.g. *S. odoratus* Hornem., by the sex of and lack of regular corolla-lobes on the marginal florets, and in some cases by the dimorphic achenes (achenes of female florets larger, more densely hairy and with a larger carpopodium than achenes of bisexual florets). They can be distinguished from disciform species of *Senecio*, e.g. *S. quadridentatus* Labill., by the last two features and also by the lower proportion of pistillate florets. Prominent tubercles around the margin of the receptacle to receive the carpopodium of achenes of female florets is a feature correlated with dimorphism of the achenes in Australian *Senecio*.

The key includes introduced radiate species; they are designated with an asterisk.

1 Involucre 12–20 mm long, with l:w ratio 5–7, phyllaries commonly bearing coarse purplish multicellular hairs; bisexual disc florets 2–5; achenes narrow-obloid, 6–8 mm long, ±glabrous.....***Arrhenechthites mixta***†

1: Involucre not entirely as above; bisexual disc florets > 5, or if less then not otherwise as above

2 Annuals; ligules to 2 mm long, sometimes vestigial....***S. glossanthus* complex**††

2: Annuals or perennials, sometimes shrubby or climbing; ligules > 2 mm long

3 Scrambling or climbing plants producing stems 2 m long or more, leaves petiolate, with the l:w ratio of lamina 1–2

4 Leaves mostly to 6 cm long, with lamina c. triangular, basal lobes large, acute, entire distal to basal lobes; unit inflorescences of 1–3 capitula on short branches; involucre 8–12 mm long; bracteoles c. 10 mm long ....***S. macroglossus****

4: Leaves mostly to 12 cm long, with lamina not triangular or if nearly so, major lobes obtuse to rounded, often toothed distal to basal lobes; unit inflorescences mostly of 10 or more capitula; involucre 5–8 mm long; bracteoles 1–3 mm long

5 Basal third of lamina of leaves not or only slightly wider than middle third; involucre 7–8 mm long; corollas of disc florets 9–12 mm long, overtopping involucre by c. 5 mm; achenes glabrous .....***S. tamoides****

5: Basal third of lamina of leaves frequently markedly wider than middle third; involucre 5–6 mm long; corollas of disc florets 5–6 mm long, overtopping involucre by c. 3 mm; achenes with scattered hairs in lines .....***S. angulatus****

3: Plant habit not as above; leaves not petiolate or if so then the l:w ratio of lamina > 2

6 Ligules pink or purple, or rarely white but then capitulum not solitary

7 Capitula small (c. 1.5 mm diam.); ligules 1–3.....***S. leucoglossus***

7: Capitula large (c. 5–8 mm diam.); ligules 13 or more
8 Leaves acutely lobate or dentate; calycular bracteoles linear-lanceolate; phyllaries 20–22 ..... ***S. glastifolius****
8: Leaves pinnatipartite; calycular bracteoles narrow-ovate; phyllaries 12–16 ..... ***S. elegans****
6: Ligules mostly yellow, if whitish then capitula solitary
9 Plant scapiform (leaves in upper 2/3 of stems much smaller than the more crowded basal and sub-basal leaves), to 0.5 m tall; receptacle and usually peduncles moderately hairy; calycular bracteoles > 4 mm long (montane to alpine)
10 Leaves ±glabrous; cauline leaves/bracts 5–15 (excluding distalmost centimetre of scape)
11 Leaves ± concolorous, leaves deeply lobate to pinnatisect, 3–6 commonly ± quadrate segments per side; inflorescence of 1(–2) capitulum; ligules yellow ..... **11.** ***S. pectinatus***
11: Leaves markedly discolorous, somewhat whitish on abaxial surface, 1–several serrations or ± triangular lobes per side; inflorescence of 1 or more capitula; ligules yellow or cream
12 Leaves 4–10 mm wide, serrations/lobes 3 or more per side; inflorescences mostly of 3 or more capitula; ligules yellow ..... ***S. leptocarpus***
12: Leaves 1–4 mm wide, serrations 1 or 2 per side; inflorescence of a solitary capitulum; ligules white or cream ..... **12.** ***S. albogilvus***
10: Leaves hairy; cauline leaves/bracts up to 5 (excluding distalmost centimetre of scape)
13 Basal leaves ± sharply demarcated into petiole and blade, usually at least some 15–40 mm wide, upper surface lacking coarse septate hairs to c. 1.5 mm long (or stout residual tubercles),, lower surface with secondary venation raised, conspicuous; capitula 1–4 ..... ***S. primulifolius***
13: Basal leaves spathulate, less than 15 mm wide, upper surface with numerous coarse septate hairs to c. 1.5 mm long (or stout residual tubercles), lower surface with secondary venation inconspicuous; capitulum solitary ..... ***S. papillosus***
9: Plant not scapiform or if so calycular bracteoles < 4 mm long; height various; receptacle and peduncles hairy or glabrous (lowland to montane)
14 Plants glaucous; leaves entire; calycular bracteoles absent; involucres all ± seamlessly fused for most of length or fused in pairs or triplets of phyllaries to produce involucral sections up to 5 mm wide; arid or semiarid regions
15 Leaves obovate–oblanceolate; involucre comprising 7-10 sections including some 3–5 mm wide (comprising 2 or 3 fused phyllaries); pappus usually to 10 mm long, minutely barbellate (visible under low magnification) ..... **3.** ***S. gypsicola***
15: Leaves linear; involucre comprising a cylinder of fused phyllaries (splitting finally into 3 or 4 sections); pappus to 30 mm long
16 Ligulate florets 5–7, commonly 5; achenes 2/3–3/4 of length of phyllaries; hairs of achenes c. 0.3 mm long; pappus 5–16 mm long at maturity (far central-western Western Australia) ..... **2.** ***S. conferruminatus***
16: Ligulate florets 7–11; achenes c. 1/2 of length of phyllaries; hairs of achenes c. 1.0 mm long; pappus 10–30 mm long at maturity (further east than above) ..... **1.** ***S. gregorii***
14: Plants glaucous or not; leaves entire or not; calycular bracteoles (0–)1–many; involucres of 12 or more unfused phyllaries (stereome boundaries clearly demarcated); habitat various

17 Involucre < 5.5 mm long, < 3 mm diam.; calycular bracteoles 4–8; ligules 4–8
18 Plants extensively rhizomatous, aerial stems to 50 cm high; inflorescences of 1–5 capitula; involucre appressed-woolly ..... ***S. behrianus***
18: Plants not extensively rhizomatous, aerial stems to 200 cm high; inflorescences of several to 100s of capitula; involucre glabrous
19 Leaves with l:w ratio 1.5–4, the lower surface densely white-tomentose ..... ***S. garlandii***
19: Leaves with l:w ratio > 4, or if less the lower surface ±glabrous.... ***S. linearifolius***
17: Plants not with all the above features
20 Plants ± grey throughout; involucre grey, 10–15 mm long x c. 10 mm diam..... ***S. crassiflorus****
20: Plants not grey throughout; involucre not entirely as above; habitat various
21 Plants biennial, rosetted in first season; leaves 2 or 3-pinnatisect, division of primary segments irregular; achenes dimorphic in terms of indumentum of ray florets glabrous, those of disc florets papillose..... ****S. jacobaea***
21: Plants of various longevity, not forming a rosette as above; leaves simple or variously pinnatisect, division of primary segments ± regular; achenes not dimorphic as above
22 Lower surface of leaves whitish or grey, indumentum closely appressed; calycular bracteoles 14–20..... ****S. pterophorus***
22: Lower surface of leaves glabrous or nearly so; calycular bracteoles mostly <14
23 Annuals to 45 cm high; achenes 4–7 mm long, narrowly lageniform with granule-like papillae or densely long-hairy, hairs obscuring the red excrescences on the surface (semiarid regions of eastern Australia)
24 Leaf-segments lobate, lobes moderately crowded, upperstem leaves often moderately hairy with long multicellular hairs; achenes of disc florets ± obloid, ribbed, densely pilose; achenes of ray florets not fertile..... **10. *S. platylepis***
24: Leaf-segments, if present, with lobes well spaced, leaves usually ±glabrous; achenes of all florets lageniform (i.e. long-attenuate apically), not ribbed, granular structures scattered to dense on unribbed surface; all achenes fertile
25 Leaves dentate to deeply lobate, axis of segments to 15 mm long, segments entire; phyllaries glabrous; achenes ± densely covered throughout by commonly whitish granules; central to southern N.S.W. northern Vic ..... **8. *S. murrayanus***
25: Leaves lobate to pinnatisect, axis of segments to 40 mm long, segments sometimes again divided; phyllaries bearing a few coarse hairs; achenes with sparse to moderately dense often translucent granules, often sparser on neck; central to northern N.S.W. and southern Qld ..... **9. *S. tuberculatus***
23: Plants commonly perennial, sometimes annual; achenes not narrowly lageniform with granule-like papillae or densely long-hairy (distribution various)
26 Leaves with a clear demarcation between petiole and lamina portions, lamina not divided, margins crowded-serrulate ..... ***S. amygdalifolius***
26: Leaves not divided into petiole and lamina portions or if so, lamina divided and margins not crowded-serrulate

27 Mid-branch/stem leaves ovate in outline, short-petiolate, pinnatisect proximally reducing progressively to dentate distally; calycular bracteoles > 5 mm long; phyllaries sometimes bearing conspicuous pigmented hairs; ligules c. 7 nerved ..... ***S. vagus***

27: Mid-branch/stem leaves not as above; calycular bracteoles < 5 mm long; phyllaries glabrous; ligules not or not consistently 7 nerved

28 Leaves thin, ± linear, 1–3 mm wide; involucre > 8 mm long, > 7 mm diam; achenes glabrous

29 Plant extensively rhizomatous; leaves lacking strap-like basal segments; pappus 12–20 mm long; lowland ..... ***S. daltoni***

29: Plant not extensively rhizomatous; leaves with strap-like basal segments; pappus < 12 mm long ....***S. macranthus***

28: Either leaves not linear or involucre shorter or narrower than above;

30 Plants often glaucous; leaves not divided; calycular bracteoles 0–6; phyllaries with stereomes ± flat on drying

31 Unit inflorescences of 1–5 capitula; phyllaries 10–15 mm long; ligules 12–20-nerved; achenes 5–7.5 mm long, nearly glabrous, papillose hairs not in distinct lines..... **6. *S. megaglossus***

31: Unit inflorescence of 3–30 capitula; phyllaries 5–11 mm long; ligules 4–13-nerved; achenes 2–6 mm long, densely papillose or papillose hairs in grooves along prominent ridges

32 Calycular bracteoles 3–6; achenes 4–5 mm long, papillose hairs ± confined to grooves at summits of ridges. ..... **5. *S. pilosicristus***

32: Calycular bracteoles 0–4; achenes either less than 4 mm long or papillose ± all over

33 Leaves hardly stem clasping (but sometimes lamina decurrent); unit inflorescences commonly with less than 20 capitula; achenes 3–7 mm long, hairs covering most of surface, lacking strongly raised ridges; pappus persistent (semiarid to arid regions) ..... **4. *S. magnificus***

33: Leaves strongly amplexicaul; unit inflorescences commonly with more than 20 capitula; achenes 2.0–3.0 mm long, hairs restricted to grooves along summit of prominent ribs; pappus not persistent (mesic regions)..... **7. *S. velleioides***

30: Plants not usually glaucous; leaves segmented or not; calycular bracteoles usually > 6; phyllaries with stereomes becoming 2-ridged in proximal half on drying unless plant a coastal succulent

34 Leaves thin, undivided or occasionally developing a few segments per side; unit inflorescences of up to 8 capitula; involucre of c. 18–22 phyllaries, achenes 1.3–2.2 mm long, < 0.5 mm diam., papillose hairs

extremely small, closely appressed (far eastern Australia mostly on and east of Great Dividing Range) ..... ***S. madagascariensis****

34: Leaves thin to fleshy or succulent, undivided or variously pinnatisect; unit inflorescences of up to 30 capitula; involucre of c. 12–22 phyllaries, achenes 1.6–7 mm long, > 0.5 mm diam., glabrous or papillose, papillose hairs larger than above..... **Lautusoid complex** (including *S. pinnatifolius* A.Rich., *S. spathulatus* A.Rich., and *S. capillifolius* Hook.f.)††

† The validity of placing this species in *Arrheneclathites*, a genus otherwise endemic to New Guinea, is currently under investigation.

††The Australian lautusoid complex and the *S. glossanthus* complex are currently being revised and several new taxa will be described (Thompson, two papers in press).

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Index of Scientific Names

Epithets of accepted names are in roman (with bold type for new names) and synonyms are in italics. The numbers refer to the number of the taxon as given in the taxonomy section. Key indicates that the species is only mentioned in the key and/or in introductory remarks.

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A new name for *Senecio glandulosus* (Asteraceae)

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Abstract

A new name, *Senecio campylocarpus* I.Thomps., is created to replace *Senecio glandulosus* (DC.) Sch.Bip., the latter being illegitimate because of an earlier homonym.

Taxonomy

In the recent revision of the disciform species of *Senecio* in Australia, I resurrected the name *S. glandulosus* (DC.) Sch.Bip. to apply to a taxon occurring in south-eastern Australia (Thompson 2004). This name, published in 1845, has been found to be illegitimate because four years earlier the same name was used for a species from Argentina. A new name for the Australian species is therefore required. The name *S. glandulosus* (DC.) Sch.Bip. has never been used in Australian floras; however, it was included by Belcher (1956) as a synonym of *S. quadridentatus* Labill. without reference to its illegitimacy.

Senecio campylocarpus I.Thomps., *nom. nov.*

Erechtites glandulosa DC., *Prodr.* 6: 295 (1838); *S. glandulosus* (DC.) Sch.Bip., *Flora oder Allgemeine Bot. Zeitung* 28: 498 (1845), *nom. illeg. non* Don ex Hook. & Arn. (1841); *E. quadridentata* var. *glandulosa* (DC.) Domin, *Biblioth. Bot.* 89: 685 (1930).

Type: New South Wales, Lachlan River ['In terris inundatis depressis ad ripas flum. Lachlan in Nova-Hollandia interiore'], *A. Cunningham 141*; holo: G (microfiche seen MEL).

Etymology: The epithet alludes to the curved marginal achenes (illustrated in Thompson 2004, fig. 4), that are typical of this species and appear more pronounced in this species than any other disciform species (Gk: *campylos*, curved, and *carpos*, fruit).

In 'Selected specimens examined' for *S. glandulosus* in Thompson (2004) two of the sub-headings were incorrect and the opportunity is taken here to correct these.

Selected specimens examined: **NEW SOUTH WALES:** Macleys Plain, *A. Cunningham 61* (MEL); McAlister Travelling Stock Reserve, c. 6.5 km SE of Laggan on Goulburn Road; headwaters of Wollondilly River, *I. Crawford 5159*, 14.xii.1998 (CANB). **AUSTRALIAN CAPITAL TERRITORY:** Canberra, Belconnen Naval Station, Ginninderra Creek, *I. Crawford 3271*, 27.x.1995 (CANB); Brooke's Creek, Federal Highway, *L.G. Adams 4194*, 12.xii.1999 (CANB). **VICTORIA:** Woori Yallock–Kooweerup Road c. 3 km south of Woori Yallock, *I.R. Thompson 704*, 14.xi.2001 (AD, BRI, CANB, MEL, NSW); Barmah Regional Park, *A.C. Beauglehole 82311*, 19.xi.1985 (AD, CANB, HO, MEL); Hepburn Regional Park, *A.C. Beauglehole 70601*, 8.v.1982 (MEL); Spadonis Reserve, to immediate west of junction of Olinda Creek and Yarra River, 2.5 km WNW of Yering, *D. Frood s.n.*, 23.x.1996 (MEL); Laverton, *W.R.A. Baker*, 20.v.1905 (MEL); Rail Reserve, Herne's Swamp, at end of access road from N, *D.E. Albrecht 5274*, 6.vi.1993 (MEL); Campaspe River, west of Redesdale, *A.C. Beauglehole 70618*, 25.iv.1982 (AD, CANB, MEL). **TASMANIA:** Near Launceston, *coll. unknown*, 21.iii.1888 (MEL); Swamp near Cressy, *J.H. Wilson*, Feb. 1943 (HO).

Acknowledgments

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